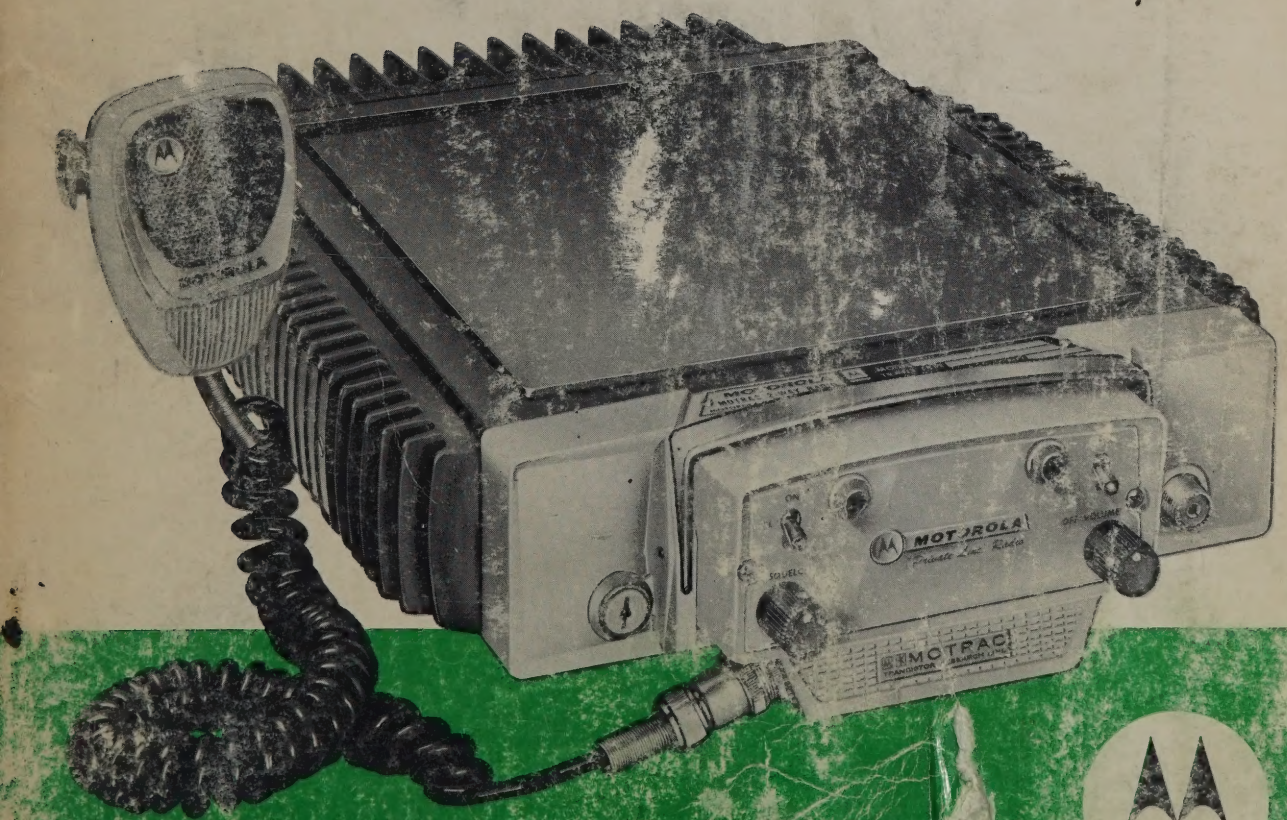
MOTRAC®

MOBILE FM TWO-WAY RADIO

406-420 & 450-470 MC
20, 40 & 60 W RF POWER
±12 VOLT SYSTEMS
MULTI-FREQUENCY OPERATION

U44LHT-1090A
U44LHT-1190A
U44LHT-3090A
U44LHT-3190A
U54LHT-1090A
U54LHT-1190A
U54LHT-3090A
U54LHT-3190A
U64LHT-1090A
U64LHT-1190A
U64LHT-3090A
U64LHT-3190A



PRINTED IN U.S.A.

[redacted]

$$\begin{array}{r} 910 \\ 260 \\ \hline 50 \end{array} \qquad \begin{array}{r} 960 \\ 260 \\ \hline 700 \end{array}$$

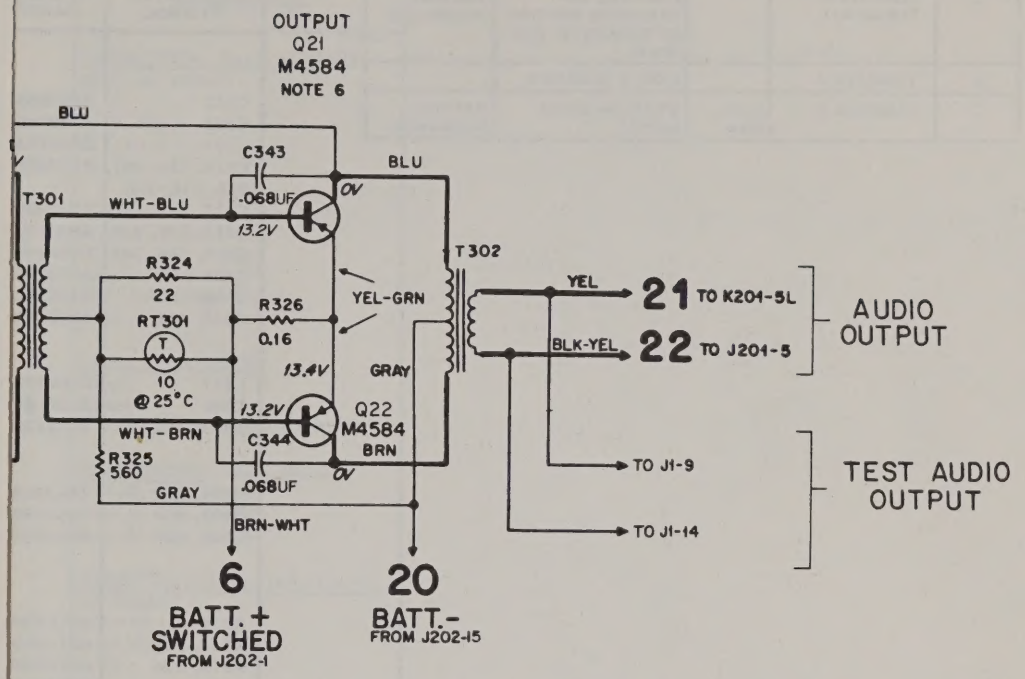
406-420 & 450-470 MC
20, 40 & 60 W RF POWER
±12 VOLT SYSTEMS
MULTI-FREQUENCY OPERATION

U44LHT-1090A	U54LHT-1090A
U44LHT-1190A	U54LHT-1190A
U44LHT-3090A	U54LHT-3090A
U44LHT-3190A	U54LHT-3190A

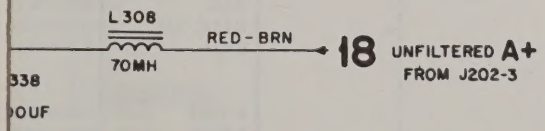
U64LHT-1090A
U64LHT-1190A
U64LHT-3090A
U64LHT-3190A

68P81043A65

EPD-14956-D
(T-2606)

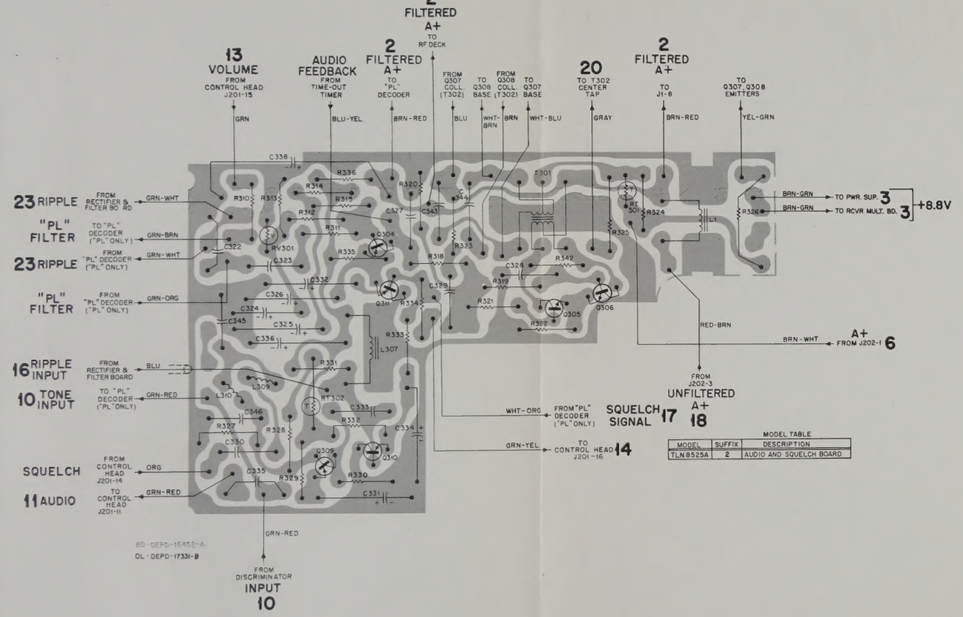


EEPD-18204-B

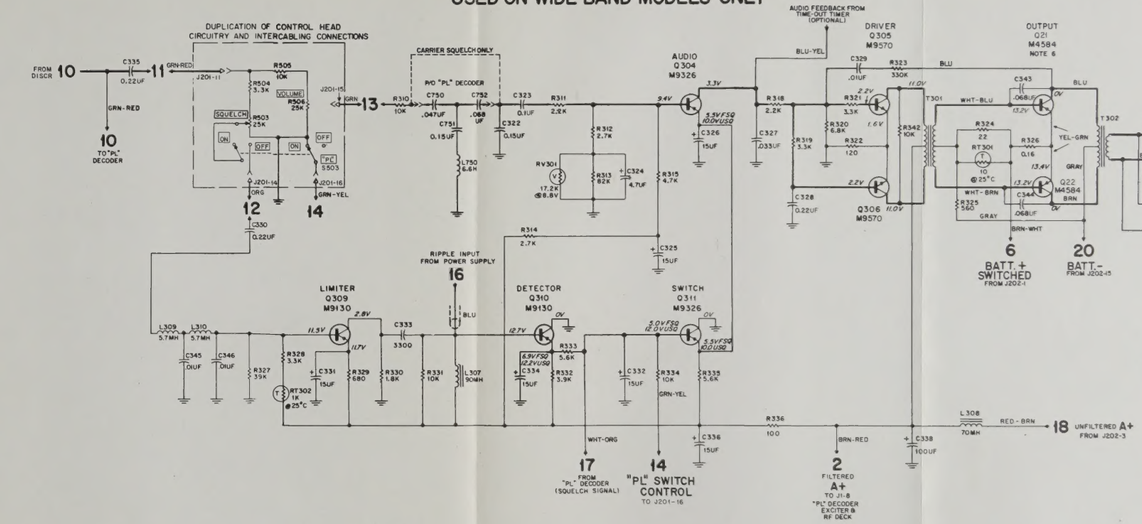


PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

Model TLN8525A-2 Audio and Squelch
Circuit Board Detail used in
"Private-Line" "Motrac" Radio Sets
Motorola No. PEPD-17455-C (SMR-116D)
5/29/68-UP



USED ON WIDE BAND MODELS ONLY



FOR MODEL TLN8525A WITH NO SUFFIX, REFER TO CIRCUIT BOARD DETAIL EPD-16965.

EPD-17493-A

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Model TLN8525A-2 Audio and Squelch Circuit Board Detail used in "Private-Line" "Motrac" Radio Sets
Motorola No. PEPD-17455-C (SMR-116D)
5/29/68-UP

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TLN8513A-1 TLN8525A-1		REMOVED EXTRANEOUS PORTION OF SCHEMATIC DIAGRAM	PARTIAL SCHEMATIC
B	TLN8513A-1		MODEL DELETED	
C	TLN8525A-2	Q305, Q306	WERE 48K869357, M9357	PARTIAL SCHEMATIC

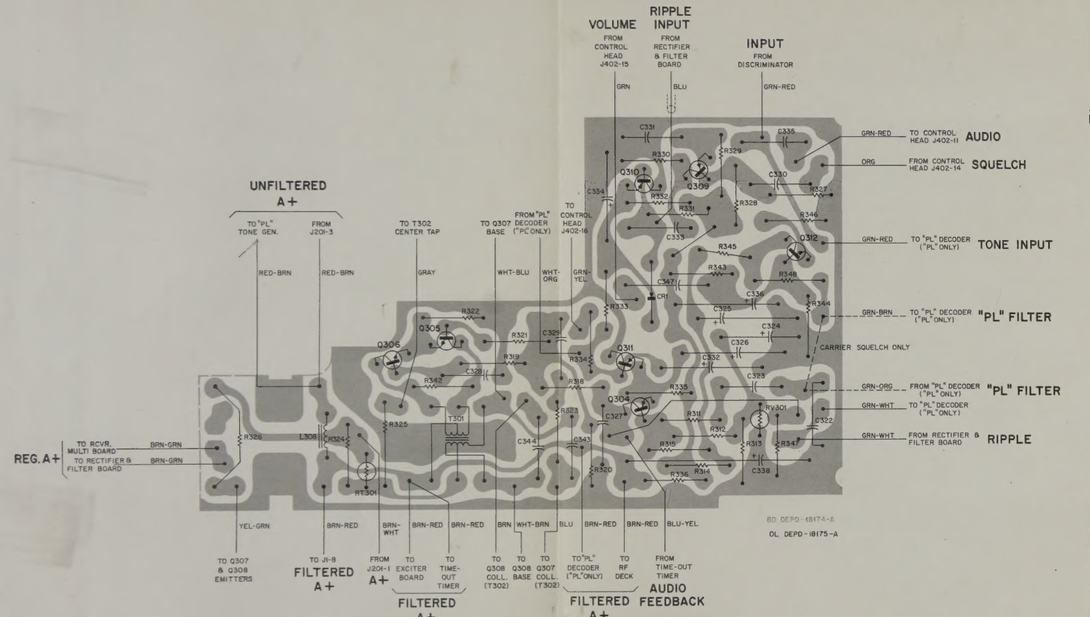
PARTS LIST

TLN8525A Audio & Squelch (Wideband) EPD-18229-A

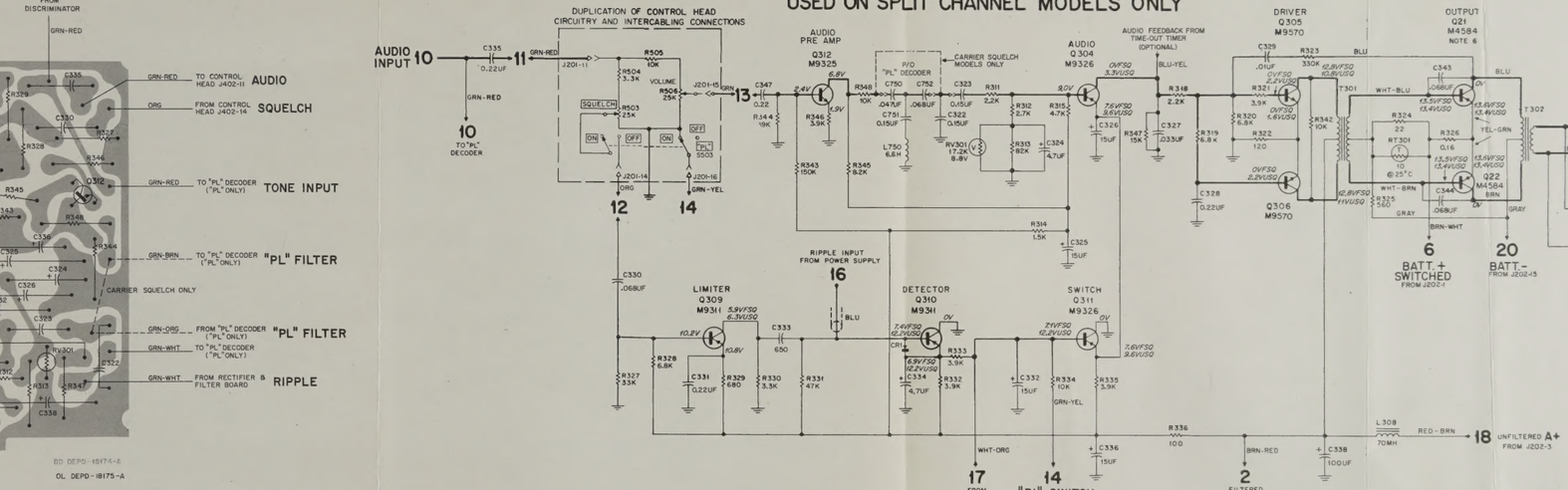
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf ±10%; 50 v; unl stated
C322	8D83293B18	0.15
C323	8D82905G07	0.10; 500 v
C324	23K865137	4.7; 25 v
C325, 326, 331, 332, 334, 336	23K865136	15; 25 v
C327	8D82905G08	.033
C328, 330, 335	8D83293B02	0.22
C329, 345, 346	8D82905G01	.01
C333	8D82905G25	.0033; 100 v
C338	23D82601A25	100 +150-10%; 20 v
C343, 344	8D82905G04	.068
		COIL, audio; choke
L307	25B82738C01	90 mh
L308	25B82878A03	70 mh
L309, 310	24C82835G05	5.7 uh; coded GRN-VIO-RED
		TRANSISTOR: (SEE NOTE)
Q304, 311	48R869326	P-N-P; type M9326
Q305, 306	48R869570	N-P-N; type M9570
Q309, 310	48R869130	P-N-P; type M9130
		RESISTOR, fixed: ±10%; 1/4 w; unl stated
R310	6S129668	10K ±5%
R311, 318	6S129804	2.2K ±5%
R312, 314	6S128688	2.7K
R313	6S129145	82K
R315	6S127804	4.7K
R319, 321, 328	6S129981	3.3K ±5%
R320	6S129237	6.8K ±5%
R322	6S129617	120
R323	6S129473	330K ±5%
R324	6S131641	22
R325	6S6291	560; 1/2 w
R326	17C82350A05	0.16; 1 w
R327	6S128903	39K
R329	6S128599	680
R330	6S129269	1.8K
R331, 334, 342	6S129225	10K
R332	6S129232	3.9K
R333, 335	6S129433	5.6K
R336	6S129753	100
		THERMISTOR:
RT301	6C82769A01	10 ohms
RT302	6B858402	1K ohms
		VARISTOR:
RV301	6B858401	17.2K; 8.8 v
		TRANSFORMER, audio driver:
T301	25C82058H01	pri. term. No. 1 term. No. 3 w/center tap @ term. No. 2 total coil res 670 ohms sec. term. No. 4 term. No. 6 w/center tap @ term. No. 5; total coil res 13 ohms

NOTE:

Replacement transistors must be ordered by Motorola part number only for optimum performance.



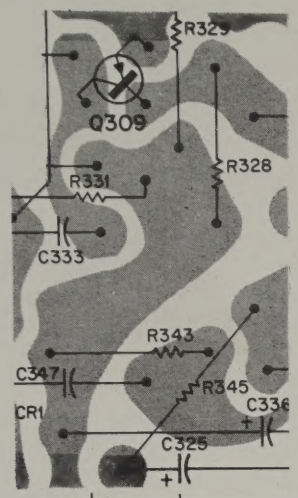
USED ON SPLIT CHANNEL MODELS ONLY



PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Model TLN8626A-2 Audio and Squelch Circuit Board Detail used in 450-470 MC "Motrac" Radio Sets
Motorola No. PEPD-18176-B (SMR-130A)
5/29/68-UP

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TLN8626A-1	R345	RELOCATED, CIRCUIT BOARD REVISED CIRCUIT WAS AS SHOWN BELOW	BELOW Q303
				
	TLN8626A-2	Q305, 306	WERE 48R869357	PARTS LIST
		R319	WAS 6S129981, 3.3K	Q306 BASE
		R321		Q305 BASE
B	TLN8626A-2	Q305, Q306	WERE 48R869532, M9532	PARTS LIST

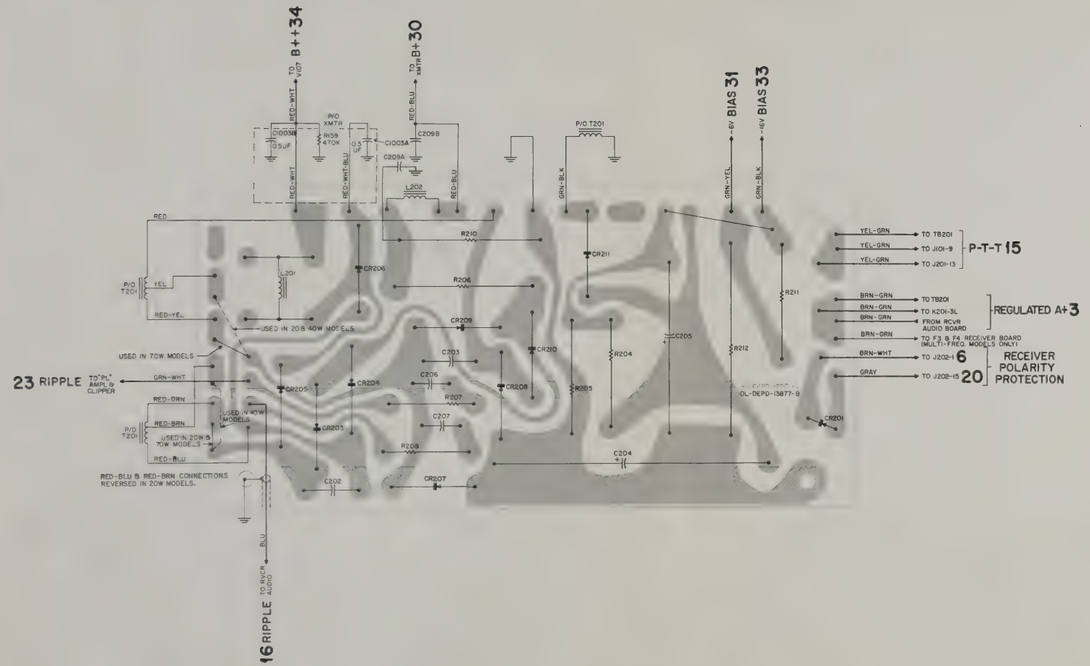
PARTS LIST

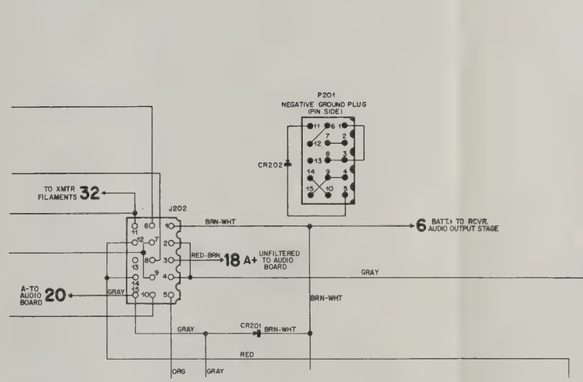
TLN8626A Audio & Squelch Kit EPD-18227-B

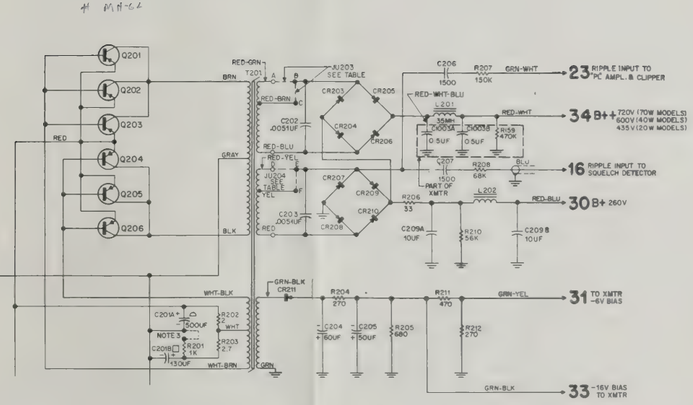
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf ±10%; 50 v; unl stated
C322, 323	8D83293B18	.15
C324, 334	23K865137	4.7; 25 v
C325, 326,332, 336	23K865136	15; 25 v
C327	8D82905G08	.033
C328, 331,335	8D83293B02	0.22
C329	8D82905G01	.01
C330, 343, 344	8D82905G04	.068
C333	21K848236	650 ±5%; 500 v
C338	23D82601A25	100 +150-10%; 20 v
C347	8D82905G12	0.22
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1	48C82392B03	silicon
		COIL, audio: choke
L308	25B82878A03	70 mh
		TRANSISTOR: (SEE NOTE)
Q304, 311	48R869326	P-N-P; type M9326
Q305, 306	48R869570	N-P-N; type M9570
Q309, 310	48R869311	P-N-P; type M9311
Q312	48R869325	N-P-N; type M9325
		RESISTOR, fixed: ±5%; 1/4 w; unl stated
R311, 318	6S129804	2.2K
R312	6S128688	2.7K ±10%
R313	6S129145	82K ±10%
R314	6S127803	1.5K ±10%
R315	6S127804	4.7K ±10%
R319, 320, 328	6S129237	6.8K
R321, 335	6S129319	3.9K
R322	6S129617	120 ±10%
R323	6S129473	330K
R324	6S131641	22 ±10%
R325	6S6291	560 ±10%; 1/2 w
R327	6S129526	33K
R329	6S129984	680
R330	6S129981	3.3K
R331	6S128902	47K ±10%
R332, 333, 346	6R129232	3.9K ±10%
R334	6S129668	10K
R336	6S129753	100 ±10%
R342, 348	6S129225	10K ±10%
R343	6S128683	150K
R344	6S129777	39K
R345	6S128686	8.2K ±10%
R347	6S129236	15K
		THERMISTOR:
RT301	6C82769A01	10 ohms ±10% @ 25°C
		VARISTOR:
RV301	6B858401	17.2K ±10%; @ 25°C
		TRANSFORMER: audio driver:
T301	25C82058H01	pri. term. No. 1 term. No. 3 w/center tap @ term. No. 2 total coil res 670 ohms sec. term No. 4 term. No. 6 w/center tap @ term. No. 5; total coil res 13 ohms

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.







PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Power Supply Rectifier and Filter Circuit Board Detail
Models TLN8319A and TLN8320A, 450-470 MC
"Motrac" Radio Sets
Motorola No. EPD-13878-A1 (SMR-230A)
9/26/68-UP

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TLN8319A	C209A	ADDED	JUNCTION L202, R206 AND R210
			ADDED 20 WATT CONNECTIONS	

PARTS LIST

TLN8319A Power Supply Chassis Ass'y — EPD-14223-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C201	23D82125B15	CAPACITOR, fixed: consists of 2 sections: ∩ 500 uf +100-10%; 25 v
C201A		□ 130 uf +50-0%; 25 v
C201B		
C209	23D82393A04	consists of 2 sections:
C209A, B		10 uf; 375 v
J202		CONNECTOR, receptacle: female; incl. 14C82338A02 INSULATOR 15 circuit; 1V80755A14 ASS'Y term. & pin, large type (4 req'd); 1V80761A91 ASS'Y term & pin small type (5 req'd)
L202	25B82878A07	COIL, AF: choke; 70 mh
R201	6S6327	RESISTOR, fixed: 1K ±10%; 1 w
R202	17C82381A13	2 ±5%; 20 w
R203	17K892226	2.7 ±5%; 1/2 w
R209	17C82177B15	4.5K ±10%; 7 w
TB201	1V80761A89	BOARD, terminal: ASS'Y; 10 lug riveted

TLN8320A Rectifier and Filter Board — EPD-14224-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C202, 203	21D82428B55	CAPACITOR, fixed: uf .0051 ±10%; 2000 v
C204	23D82601A29	60 +150-10%; 50 v
C205	23D82601A36	50 +150-10%; 35 v
C206, 207	21D82428B38	.0015 +10-0%; 500 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR201	48C82525G05	silicon
CR203, 204, 205, 206	48C82466H18	silicon
CR207, 208, 209, 210	48C82466H16	silicon
CR211	48C82466H12	silicon
L201	25C83124C01	COIL, AF: choke; 35 mh
		RESISTOR, fixed: ±10%; 1 w; unl. stated
R204, 212	6S6336	270
R205	6S5594	680
R206	17C82177B02	33 ±5%; 5 w
R207	6R6398	150K; 1/2 w
R208	6S6074	68K; 1/2 w
R210	6S5592	56K; 2 w
R211	6S5593	470

TLN8321A Relay Kit — EPD-14225-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
K201	80D83755C01	RELAY, armature: left stack; 1 form "C"; 1 form "B"; right stack; 1 form "A"; coil res. 80 ohms; 9 v

TLN6197A Heat Sink Kit — PL-105-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q201 thru 206	48A124331	TRANSISTOR: (SEE NOTE) P-N-P
NON-REFERENCED ITEM		
	15D82215A03	RADIATOR: 2 req'd

TLN8322A Transformer Kit — EPD-14226-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
T201	25D83756C01	TRANSFORMER, power: pri no. 1: BRN, BLK with GRAY tap total res .0158 ohms pri no. 2: WHT-BLK, WHT-BRN with WHT tap total res .03 ohms sec no. 1: RED-BLU, RED-GRN with RED-BRN tap; coil res 6.7 ohms sec no. 2: RED, RED-YEL with YEL tap coil res 4 ohms sec no. 3: GRN-BLK, GRN res 0.5 ohms
NON-REFERENCED ITEM		
	29K865067	LUG, ring tongue (2 req'd)

NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.

IDC ADJUSTMENT

1. INTRODUCTION

Accuracy of test equipment is of prime importance to any user of radio communications equipment; but of equal importance is a knowledge of the characteristics of the measuring equipment under various conditions. The Motorola T1130A Series Station Monitor provides sufficient sensitivity and accuracy under conditions of variable environmental temperature, line voltage, and r-f input signal level to measure deviation with sinewave modulation in any wideband equipment. Like most meter-type measuring devices, the T1130A responds differently to different waveforms and is used only to calibrate an oscilloscope for measurement of the clipped and integrated waveform resulting from deviation control by Motorola's "IDC" circuit.

The Motorola S1079A Deviation Monitor/Frequency Synthesizer (used with the high resolution S1075B Digital Frequency Meter to constitute Model S1078A) provides a highly accurate means of measuring frequency deviation directly from the r-f output of the transmitter. The peak-reading deviation meter used in this unit has the high sensitivity necessary for measuring the low deviation of split-channel transmitters. It is also provided with sensitivity ranges appropriate for wideband measurements.

2. PROCEDURE WITH PEAK-READING DEVIATION MONITOR (Split-Channel or Wideband Equipment)

a. Test Equipment Required

(1) Motorola S1078A Digital Frequency Meter with Deviation Monitor/Frequency Synthesizer (or equivalent).

(2) Motorola Transistorized AC Voltmeter (or equivalent)

(3) Motorola Model TEK-1A Transistorized Tone Generator, 1000 cps

(4) Motorola Model S1056A-9A or TU546 Series Portable Test Set (necessary for "Private-Line" models only)

b. Setting Up Test Equipment

(1) To monitor transmissions for deviation adjustment, the antenna provided with the Digital Frequency Meter should be connected to the ANTENNA input of the Deviation Monitor/Frequency Synthesizer and placed within a few feet of the transmitter.

(2) Place the function switch on the Deviation Monitor/Frequency Synthesizer in the SET OSC. position.

(3) Set the local oscillator 500 kc above or below the assigned carrier frequency of the transmitter. The frequency of the local oscillator will appear on the digital readout.

(4) Place the function switch in the LIMITER 500 KC OUT position. Key the transmitter and observe the limiter reading on the front panel meter. If the meter pointer is above the red markings at 6/3 kc, the antenna input is adequate.

(5) Move the function switch to ZERO SET and zero the front panel meter.

(6) To measure deviation, set the function switch to the appropriate (16 KC, 8 KC, or 1.6 KC) position. When in the 1.6 KC position, the transmitter should remain keyed to prevent noise from pinning the meter.

c. Measurement and Setting of Transmitter Deviation

(1) For "Private-Line" transmitters, the tone deviation should be checked before the total modulation deviation is measured. This may be read on the deviation meter directly by keying the transmitter.

DO NOT USE A LIVE MICROPHONE FOR CHECKING "PRIVATE-LINE" TONE DEVIATION. The deviation of the "Private-Line" tone should be 0.5 to 1.0 kc for split-channel models or 1.0 to 2.0 kc for wideband models.

(2) Feed a 1000 cps test tone into the transmitter audio input. Adjust the signal to 1 volt. A 0.33 uf capacitor should be placed in series with the tone generator output. An audio oscillator should be used for generation of this tone. The Motorola TEK-1A Transistorized Tone Generator is excellent for this purpose.

(3) With this input signal level, adjust the IDC control on the transmitter to provide a deviation reading of ±5 kc (split-channel) or ±15 kc (wideband) on the front panel meter.

3. PROCEDURE WITH CALIBRATED OSCILLOSCOPE (Wideband Equipment Only)

a. Test Equipment Required

(1) Motorola T1130A Series Station Monitor or equivalent.

NOTE

For 406-420 mc applications a special version of the Motorola FM Station Monitor must be used. This equipment is available on special order only. For further details, consult your Motorola representative.

(2) Motorola Transistorized AC Voltmeter (or equivalent)

(3) Motorola Model TEK-1A Transistorized Tone Generator, 1000 cps (or equivalent)

(4) Motorola Model T1015A General Purpose Oscilloscope or Model T1014B Wide Band Oscilloscope

(5) Motorola Model S1056A-9A or TU546 Series Portable Test Set for "Private-Line" transmitters

b. Setting Up Test Equipment

When using the T1130A Series Station Monitor with 420-470 mc transmitters, place the monitor antenna within a few feet of the transmitter. This enables the monitor receiver to pick up r-f from the stage preceding the final tripler, which is within the frequency range of the monitor receiver. As a result, the maximum frequency deviation measured will be ±5 kc (read on the 0-10 kc scale), which is one-third of the actual deviation of ±15 kc. It should be noted that calibration of the oscilloscope, as mentioned in the following paragraphs, takes this into consideration.

c. Oscilloscope Calibration

The first step in the measurement of the transmitter deviation is to calibrate the oscilloscope. This can be done by using the transmitter which is to be measured.

Proceed as follows:

(1) If the transmitter is a part of "Private-Line" station remove the "Vibrasender" resonant reed from its socket.

(2) Connect the oscilloscope to the monitor oscilloscope terminals, and set up the monitor controls in accordance with the monitor instruction manual.

(3) Turn the IDC control on the transmitter chassis to the full clockwise position.

(4) Feed a 1000 cps test tone into the transmitter audio input. Modulate the transmitter with this tone so adjusted that the deviation as read on the FM monitor deviation meter is ±2 kc. An audio oscillator must be used for generation of this tone, since a sinusoidal waveform is very important. The Motorola TEK-1A Transistorized Tone Generator is excellent for this purpose.

(5) Adjust the vertical gain of the oscilloscope so that the total recovered (peak-to-peak) audio pattern occupies some convenient height, e.g., four small squares, as shown in figure 1.

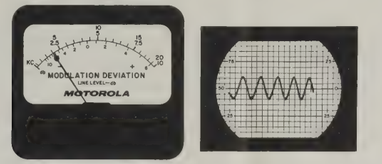


Figure 1.
Oscilloscope Calibration of Transmitter

Having calibrated the oscilloscope, there is no further need for the modulation deviation meter. Ignore its reading from this point on. It has already performed its important function of calibrating the oscilloscope.

With the oscilloscope calibrated as indicated, a recovered signal which occupies 10 squares (peak-to-peak) is equivalent to ±5 kc deviation at the stage preceding the final tripler.

d. Measurement and Setting of Transmitter Deviation (Carrier-Squelch Models)

Once the oscilloscope has been calibrated the transmitter deviation can be properly adjusted by the following method.

(1) Adjust the signal applied to the transmitter audio input to 1 volt.

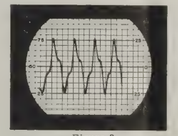


Figure 2.
15 KC Peak Deviation as seen on the Oscilloscope
(NOTE: Waveform is clipped fully)

(2) With this input signal level, adjust the IDC control on the transmitter to provide a 10-square peak-to-peak recovered signal on the oscilloscope. This is equivalent to ±5 kc deviation (preceding the tripler; see figure 2) or ±15 kc deviation of the actual carrier.

e. Measurement and Setting of Transmitter Deviation ("Private-Line" Models)

Once the oscilloscope has been calibrated, the transmitted deviation can be properly adjusted by the following method.

(1) Replace the "Vibrasender" resonant reed in its socket and check the "Private-Line" tone deviation. This may be read directly from the oscilloscope by pressing the transmitter push-to-talk switch on the test set. DO NOT USE A "LIVE" MICROPHONE FOR CHECKING "PRIVATE-LINE" TONE DEVIATION. The tone deviation should be (±) 0.33 to 0.66 kc (preceding the tripler) or 1 to 2 kc deviation of the actual carrier.

NOTE

Due to a slight increase in discriminator response at the lower frequencies, the oscilloscope will read high, thus, as indication of 0.9 to 1.8 squares (peak-to-peak) is equivalent to (±) 0.33 to 0.66 kc deviation preceding the tripler or 1 to 2 kc deviation of the actual carrier. This slight variation is only important when checking the tone deviation. When setting maximum transmitter deviation as described below, it may be ignored.

(2) Adjust the 1000 cps input signal to the transmitter audio input to 1 volt.

(3) With this input signal level, adjust the IDC control on the transmitter to provide a 10-square (maximum limit) peak-to-peak recovered signal on the oscilloscope. This is equivalent to ±5 kc deviation (preceding the tripler; see figure 3) or ±15 kc deviation of the actual carrier.

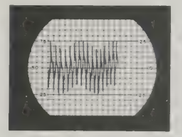


Figure 3.
15 KC Peak Deviation for
Combined PL Tone and 1000 CPS Modulation

4. EMERGENCY MEASUREMENT OF DEVIATION

If an audio oscillator is not available, a loud sustained whistle of approximately 1000 cycles can be used for a rough measurement of deviation. If this rough check indicates the need for resetting deviation, do so only under controlled conditions, using a 1000 cps tone as previously indicated. The calibration of the oscilloscope should always be performed with a steady controlled signal. Do not attempt to calibrate the oscilloscope with a sustained whistle as waveform distortion will prevent an accurate calibration.

5. OTHER MEANS FOR MEASUREMENT OF DEVIATION

Another accurate means of measuring transmitter deviation is to use the Motorola T1021B Frequency Meter and the Motorola S1058A or S1059A Test Set (with deviation meter) for measuring deviation. These units, properly used, permit the accurate measurement and setting of transmitter deviation from a peak-reading meter, which is unaffected by waveform. An oscilloscope is not required with these instruments. With these devices, the transmitter deviation can be measured accurately even with voice modulation.

6. DEVIATION CONSIDERATIONS

The foregoing procedure will insure that the transmitter will comply with FCC requirements for maximum deviation.

The importance of the correct deviation setting can not be overemphasized. Optimum system performance demands accurate deviation setting, both from the standpoint that overdeviation will interfere with the user on the adjacent channel, and underdeviation may reduce system range.

INSTRUCTION MANUAL REVISION SMR-296

GENERAL

This revision outlines changes that have occurred since the printing of your insturction manual. Use this information to correct your manual.

INSTRUCTION MANUAL(S) AFFECTED:

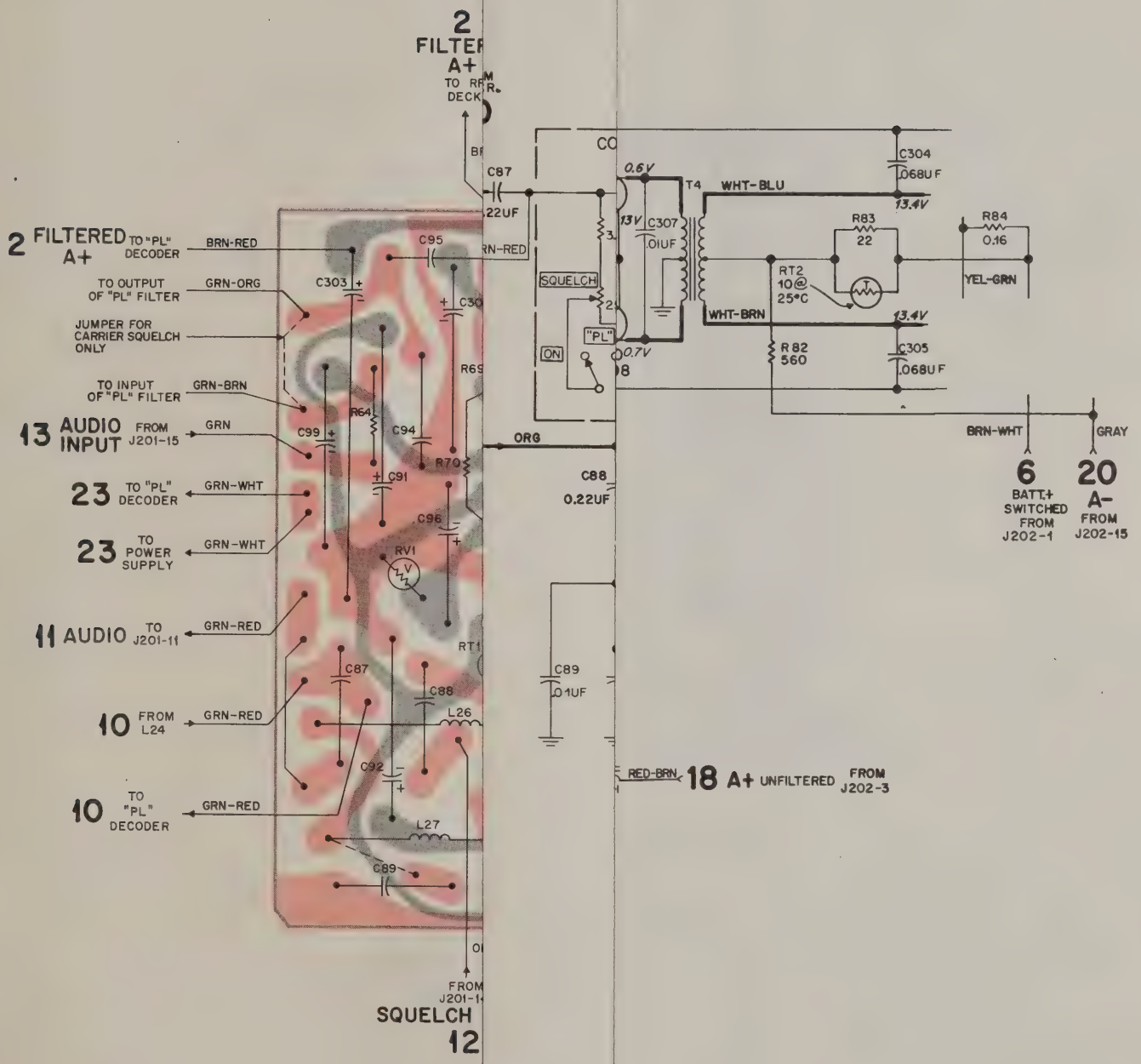
68P81002E85-O 450-470 MHz "Motrac" Mobile FM Two-Way Radio

REVISION DETAILS

On page 18 under "7. PILOT LIGHT DIMMER":

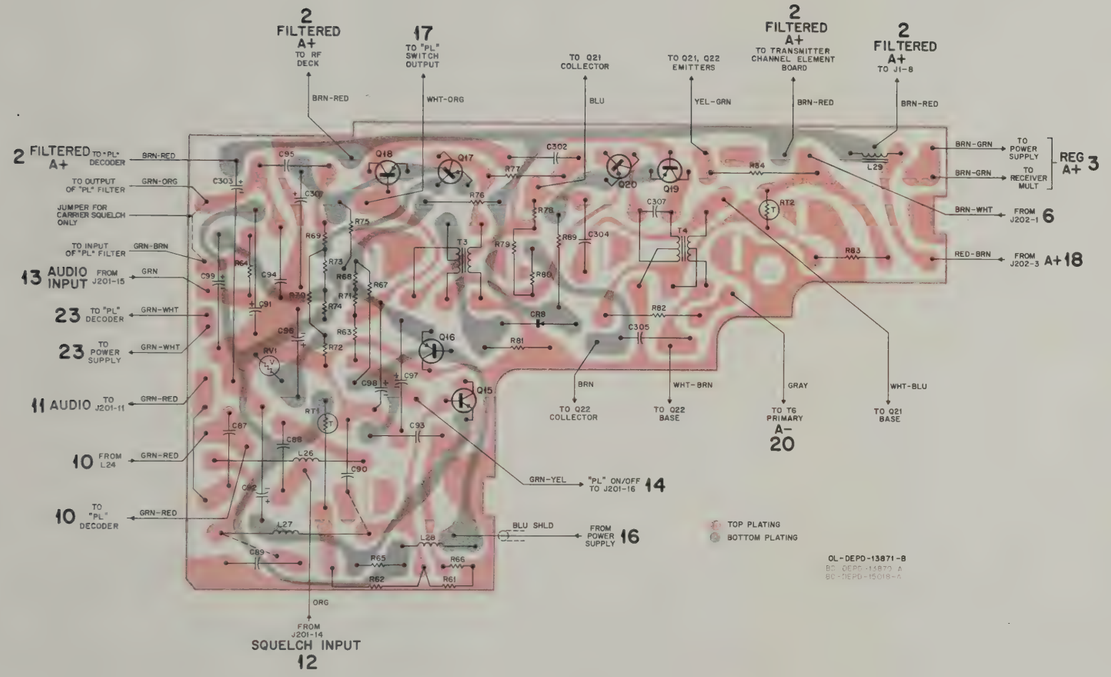
(1) In the second paragraph, change both references to LDR (R509) to read LDR (R513).

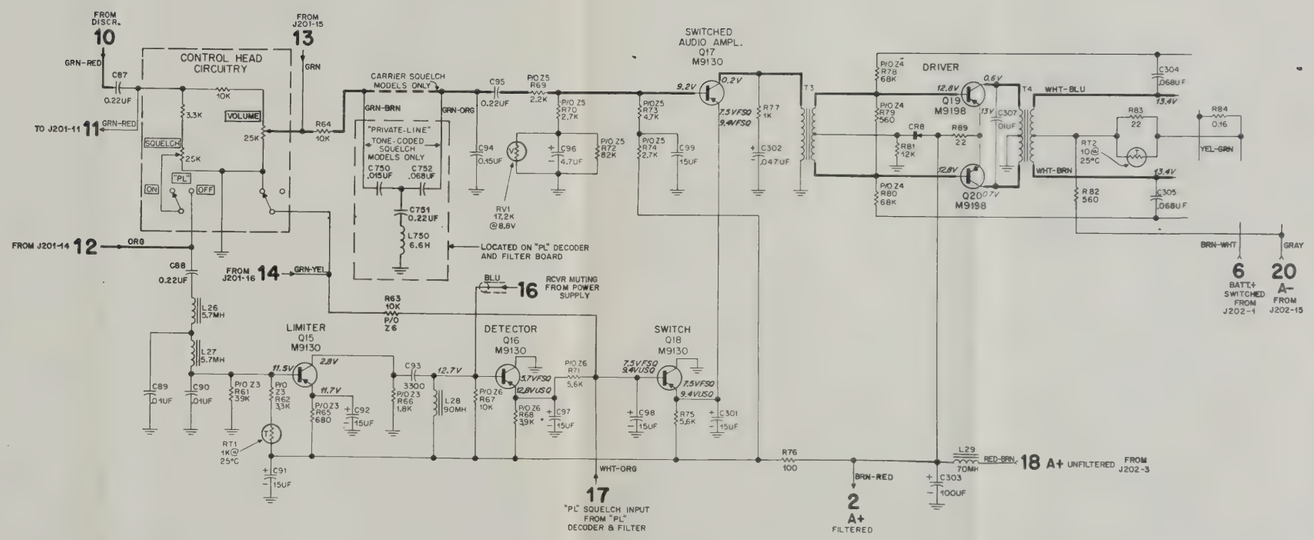
(2) In the fourth paragraph, change the first sentence to read DS502 and R512. . . .



PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Audio and Squelch Circuit Board Detail
Model TLN8268A, 450-470 MC
"Motrac" Radio Sets
Motorola No. EPD-13872-C (MR-2022A)
9/26/66-UP



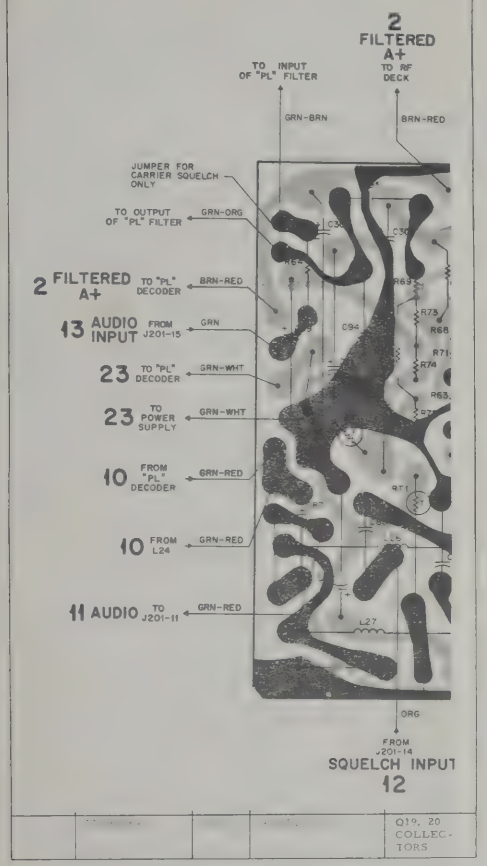


PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Audio and Squelch Circuit Board Detail
Model TLN8268A, 450-470 MC
"Motrac" Radio Sets
Motorola No. EPD-13872-C (MR-2022A)
9/26/66-UP

REVISIONS

DIAG ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	- -	- -	- -	- -
B	TLN8268A-1		PLATED CIRCUIT BOARD REVISED. CIRCUIT WAS AS SHOWN BELOW	LEFT SID OF BOARD



PARTS LIST

TLN8268A Audio & Squelch Board (Wide) EPD-14202-A

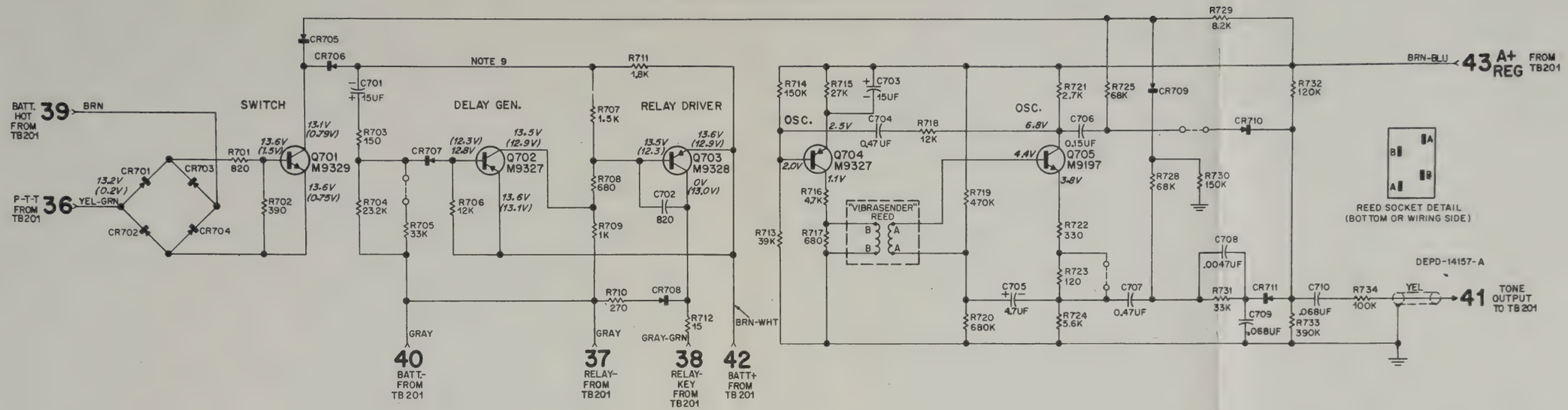
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf ±10%; 50 v; unl stated
C87, 95	8D82905G11	0.22
C88	8D82905G12	0.22
C89, 90	8D82905G14	.01; 100 v
C91, 92, 97, 98, 301	23K865136	15 ±20%; 25 v
C93	8D82905G25	3300 uuf; 100 v
C94	8D82905G05	0.15
C96	23K865137	4.7 ±20%; 25 v
C99	23D83214C02	15 uuf; ±20%; 25 v
C302	8D82905G03	.047
C303	23D82601A25	100 +150-10%; 20 v
C304, 305	8D82905G04	.068 uuf
C307	21K832501	.01 +60-40%; 250 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR8	48C82178A06	germanium
		COIL, AF: choke:
L26, 27	24C82835G16	5.7 mh
L28	25B82738C01	90 mh
L29	25B82878A03	70 mh
		TRANSISTOR: (SEE NOTE)
Q15, 16, 17, 18	48R869130	P-N-P; type M9130
Q19, 20	48R869198	P-N-P; type M9198
		RESISTOR, fixed: ±10%; 1/4 w; unl stated
R61		39K (p/o Z3)
R62		33K (p/o Z3)
R63		10K (p/o Z6)
R64	6S129225	10K
R65		680 (p/o Z3)
R66		1.8K (p/o Z3)
R67		10K (p/o Z6)
R68		3.9K (p/o Z6)
R69		2.2K (p/o Z5)
R70		2.7K (p/o Z5)
R71		5.6K (p/o Z6)
R72		82K (p/o Z5)
R73		4.7K (p/o Z5)
R74		2.7K (p/o Z5)
R75	6S129433	5.6K
R76	6S129753	100
R77	6S127802	1K
R78		68K (p/o Z4)
R79		560 (p/o Z4)
R80		68K (p/o Z4)
R81	6S129230	12K
R82	6S6291	560; 1/2 w
R83	6S131641	22
R84	17C82350A05	0.16; 1 w
R89	6S6406	22; 1/2 w
		THERMISTOR:
RT1	6B858402	1K @ 25°C
RT2	6C82769A01	10 @ 25°C
		VARISTOR:
RV1	6B858401	17.2K ±10%; 8.8 v @ 25°C
		TRANSFORMER, audio:
T3	25C82054H01	pri: PINS 1 & 3 coil res. 330 ohms sec: PINS 4 & 6 with C.T. @ PIN 5; total coil res 15.5 ohms
T4	25C82058H01	pri: PINS 1 & 3 with C.T. @ PIN 2; total coil res. 670 ohms sec: PINS 4 & 6 with C.T. @ PIN 5; total coil res. 13 ohms
		NETWORK, resistor:
Z3	51C83478C01	incl. R61, R62, R65, R66
Z4	51C83478C02	incl. R78, R79, R80
Z5	51C83478C03	incl. R69, R70, R72, R73, R74

NOTE:

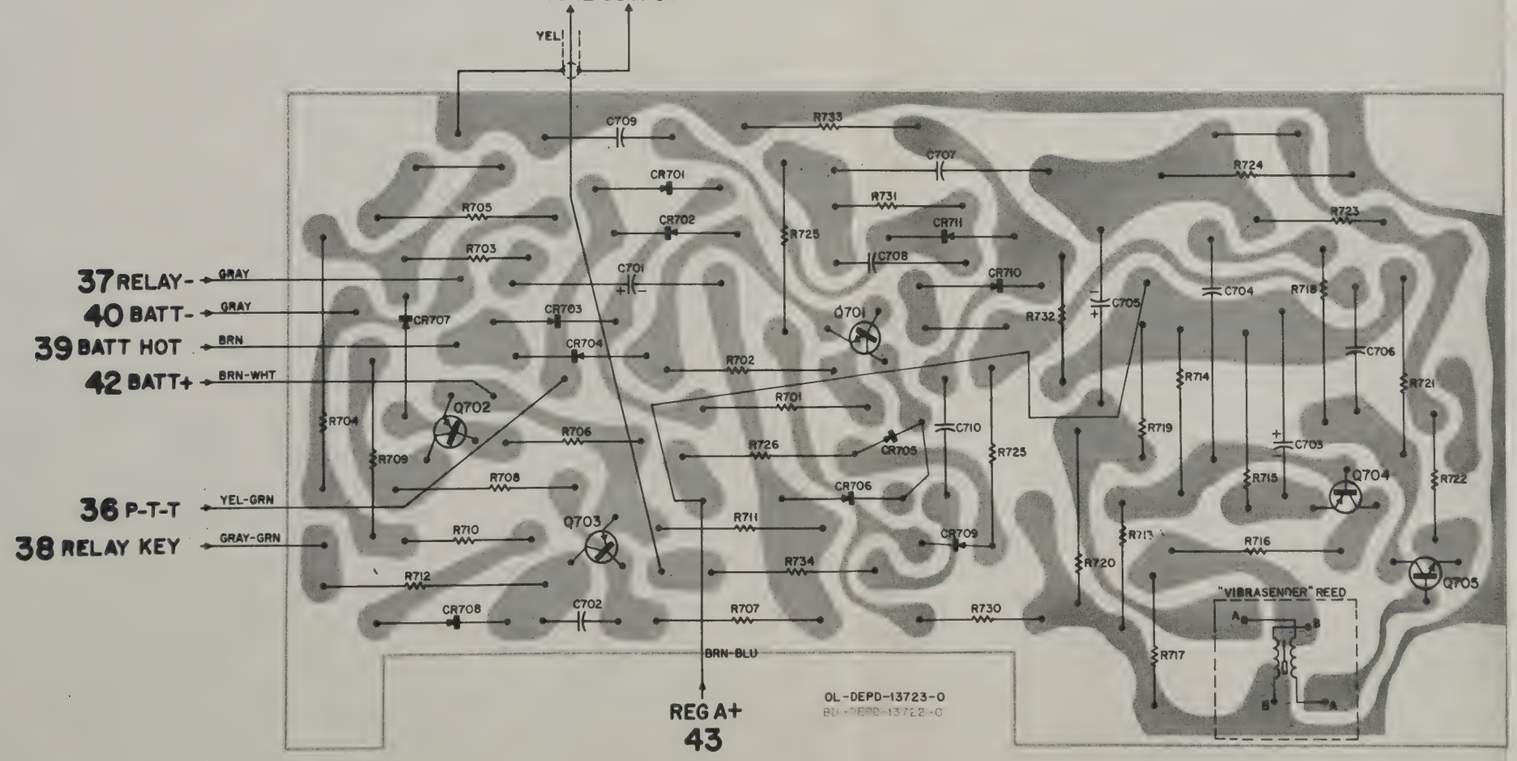
Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.

"PRIVATE-LINE" TONE GENERATOR

("PRIVATE-LINE" MODELS ONLY)



41
TONE OUTPUT



PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

"Private-Line" Tone Generator
Circuit Board Detail
Model TLN8271A, 450-470 MC
"Private-Line" "Motrac" Radio Sets
Motorola No. EPD-13724-A

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TLN8271A	R730	WAS 6S129667; 22K	OUTPUT OF DIAGRAM
		R732	WAS 6K129010; 680K	
		R733	WAS 6R5697; 560K	

PARTS LIST

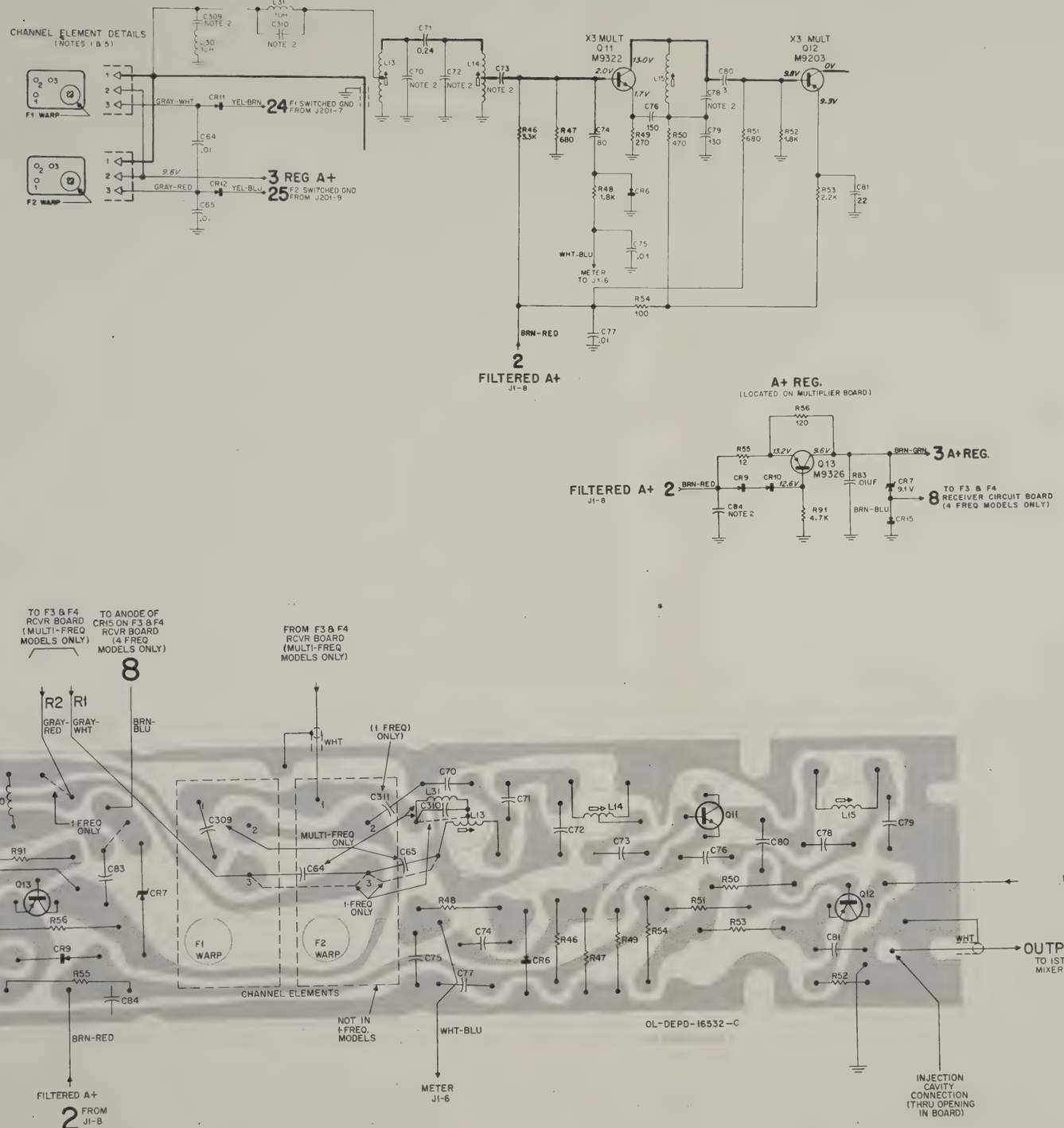
TLN8271A "Private-Line" Oscillator and Delay Board

EPD-14229-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf ±10%; 25 v; unl. stated
C701	23D82783B24	15
C702	21D82187B21	820 uuf; 200 v
C703	23K865136	15 ±20%
C704, 707	8D82905G33	0.47 ±20%; 50 v
C705	23K865137	4.7 ±20%
C706	8D82905G34	0.15 ±5%; 50 v
C708	8D82905G26	.0047; 100 v
C709, 710	8D82905G04	.068; 50 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR701 thru 710	48C82392B03	silicon
CR711	48C82392B04	silicon
		TRANSISTOR: (SEE NOTE)
Q701	48R869329	N-P-N; type M9329
Q702, 704	48R869327	P-N-P; type M9327
Q703	48R869328	P-N-P; type M9328
Q705	48R869197	N-P-N; type M9197
		RESISTOR, fixed: ±5%; 1/2 w unl. stated
R701	6S119172	820
R702	6S400804	390
R703	6S129862	150 ±10%; 1/4 w
R704	6D83175C32	23.2K ±10%; 1/4 w
R705	6S2068	33K
R706, 718	6S129887	12K
R707	6S400459	1.5K
R708	6S5651	680
R709	6S6411	1K
R710	6S129752	270 ±10%; 1/4 w
R711	6S2089	1.8K ±10%
R712	6S118227	15 ±10%; 1 w
R713	6S129777	39K
R714	6S5559	150K
R715	6S129886	27K; 1/4 w
R716	6S3924	4.7K
R717	6S129984	680; 1/4 w
R719	6K129149	470K; 1/4 w
R720	6R5775	680K
R721	6R5577	2.7K
R722	6K129806	330; 1/4 w
R723	6K129617	120
R724	6S129982	5.6K; 1/4 w
R725	6K129144	68K ±10%; 1/4 w
R728	6R6074	68K ±10%
R729	6S2004	8.2K ±10%
R730	6S128683	150K; 1/4 w
R731	6S129526	33K; 1/4 w
R732	6K128987	120K; ±10%; 1/4 w
R733	6R5777	390K
R734	6S5553	100K

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.



MODEL	SUFFIX
TLN8311A	
TLN8313A	2
TLN8541A	2

FOR UNITS WITHOUT A SUFFIX, REFER TO CIRCUIT BOARD DIAGRAM EPD-13785.

EPD-16602-B

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

1st Oscillator & Multiplier Circuit Board Detail
Models TLN8311A, TLN8313A and TLN8541A
406-420 & 450-470 MC "Motrac" Receivers
Motorola No. EPD-16533-C (T-2502C)
3/6/67-UP

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TLN8313A-2 TLN8541A-2	C309, 310, 311	ADDED	CENTER OF CIRCUIT BD.
		L31	ADDED	
		L30	ADDED	TOP LEFT OF CIRCUIT BD.
B	TLN8541A-2	L13	WAS 24V80905A64 (ADDED REF. PARTS C310 & L31)	TOP CENTER OF CIRCUIT BOARD
C	TLN8311A		ADDED	PARTS LIST

PARTS LIST

TLN8311A Oscillator Kit
(Multiple-Frequency Operation) 406-420 MC
TLN8313A Oscillator Kit
(Single-Frequency Operation) 450-470 MC
TLN8541A Oscillator Kit
(Multiple-Frequency Operation) 450-470 MC

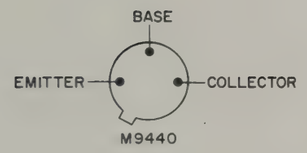
EPD-14203-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf; ±5%; 500 v; unl stated
C64, 65, 75, 77, 83	21C82428B59	.01 uf +80-20%; 200 v
C70, 72	21K840845	24; N220 (TLN8313A, TLN8541A)
	or21K849335	30; N150 (TLN8311A)
C71	21D82450B05	0.24 ±10%; NP0
C73	21D82610C03	47; 200 v; N220 (TLN8313A & TLN8541A only)
	or21D82610C47	57; 100 v; N220 (TLN8311A only)
C74	21D82133G09	80; N750
C76	21D863147	150 ±10%; 400 v
C78	21D82133G11	4 ±0.5 uuf; NP0 (TLN8313A, TLN8541A)
	or21K849333	6 .25 uuf; N330 (TLN8311A)
C79	21D82610C28	130; 200 v; N470
C80	21K868935	3 ±0.25 uuf; 2000 v; N750
C81	21D82133G20	22 ±5%; N330
C84	21D82187B29	1000 ±10%; 100 v (TLN8311A only)
C309	21K831125	100 ±10%; 300 v (TLN8313A & TLN8541A only)
	or21D82610C27	120; 200 v; N470 (TLN8311A only)
C310	21K861436	100 ±10%; 75 v (TLN8313A & TLN8541A only)
	or21D82877B41	120 ±10%; 75 v; N750 (TLN8311A only)
C311	21K832501	.01 uf +60-40%; 250 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR6	48C82921G02	germanium
CR7	48D82256C43	silicon; zener type (single-frequency)
	or48D82256C56	silicon; zener type (multi-frequency)
CR9, 10	48C82392B05	silicon
		COIL, RF:
L13	24V80906A29	incl. ref. parts C310, L31 and 76B82098H01 CORE, tuning
L14	24V80905A64	incl. 24B83868D01 COIL, tapped 76B82098H01 CORE, tuning
L15	24V80905A19	incl. 24B83670C01 COIL, 4-3/4 turns; 76B82098H01 CORE, tuning
L30, 31	24B864019	choke; 1 uh
		TRANSISTOR: (SEE NOTE)
Q11	48R869322	N-P-N; type M9322
Q12	48R869203	P-N-P; type M9203
Q13	48R869326	P-N-P; type M9326
		RESISTOR, fixed: ±10%; 1/4 w unl stated
R46	6S129231	3.3K
R47, 51	6S128599	680
R48, 52	6S129269	1.8K
R49	6S129752	270
R50	6S127801	470
R53	6S128689	2.2K
R54	6S129753	100
R55	6S114262	12 ±5%; 1/2 w
R56	6S5551	120; 1/2 w
R91	6S6080	4.7K; 1/2 w
NON-REFERENCED ITEM		
	26A82076C01	SHIELD, coil (used with L13, L14, L15)

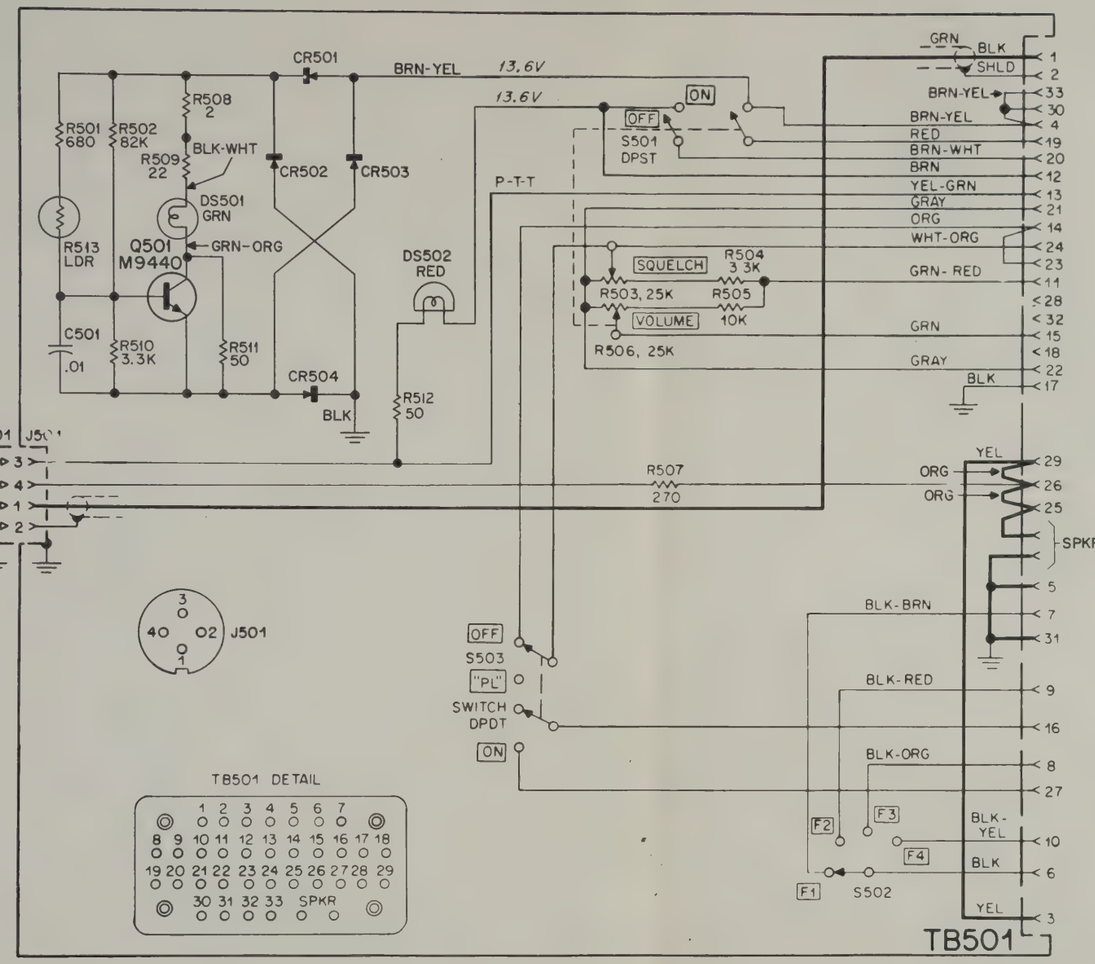
NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

MICROPHONE



CONTROL HEAD



63D81000E02-01

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

PARTS LISTS FOR PRINTED CIRCUIT BOARDS ARE ON THE BACK OF THE CORRESPONDING PRINTED CIRCUIT BOARD DETAILS

TCN6098BK Control Head (4-Frequency "Private-Line" Tone-Coded Squelch with Dimmer)

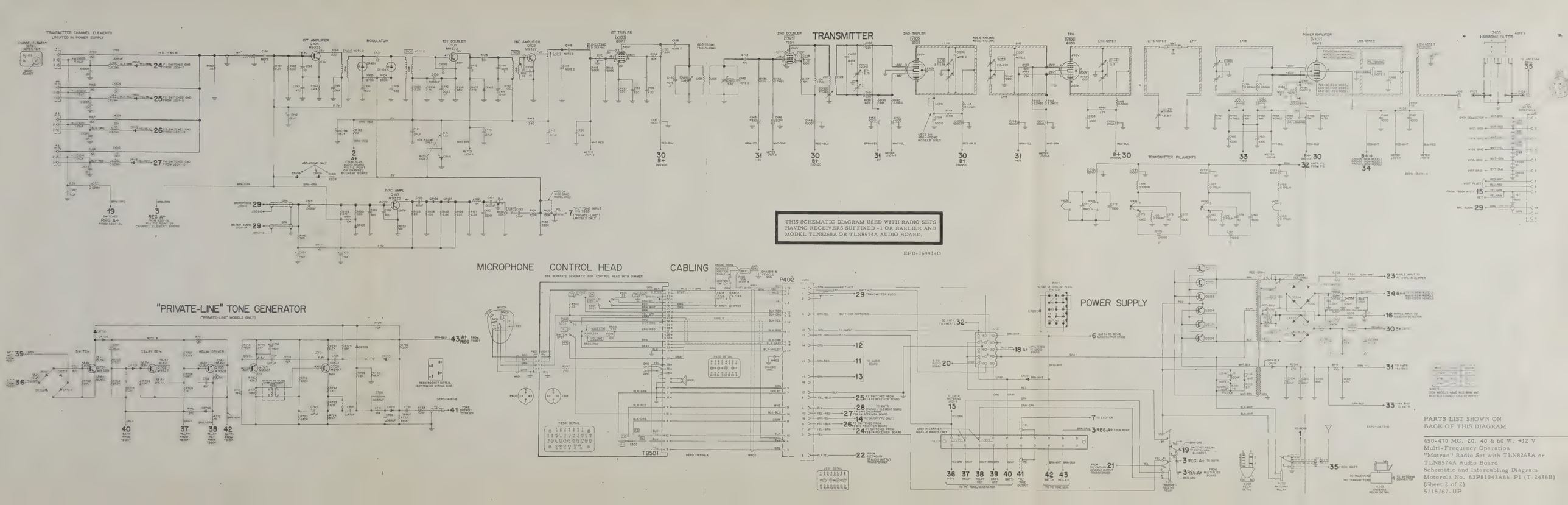
PL-152-A

DS501, 502	65S4151	LAMP, incandescent: min. bay; 6-8 v; 0.2 a; type no. 51
J501	65S4151	CONNECTOR, receptacle: female; 4 contact; does not incl. 4S7699 LOCKWASHER: 13/16" internal; 2A482070 NUT, machine: ring (knurled)
		RESISTOR, fixed: ±10%; unl. otherwise stated
R503	18K857840	var: 25K ±30%; 0.33 w
R504	6R5581	3.3K; 1/2 w
R505	6R6320	10K; 1/2 w
R506	18K857698	var: 25K ±30%; 0.16 w
R507	6S6336	270; 1 w
R512	17D82177B05	50; 5 w
		SWITCH:
S501, 503	40A80246	toggle: dpdt
S502	40C83624D01	rotary; 1 pole; 4 position
		TERMINAL BOARD:
TB501	31C83826D01	35 female contact terminals
		LAMPHOLDER:
XDS501, 502	9B863168	min. bay
NON-REFERENCED ITEMS		
	61B83678D01	LENS, lampholder: RED
	61B83678D02	LENS, lampholder: GRN
	3A82670A01	SCREW, machine: special type; 2 req'd
	36K858652	KNOB control 2 req'd (VOL, SQ.)
	36B82869D01	KNOB, control (F1-F4)
	26B83806D01	SHIELD, light (for R513)
	15C82401D01	COVER, housing
	15D83576D03	HOUSING, control head
	13D82286C22	ESCUTCHEON, cont. hd.

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
01			COVER, HOUSING AND ESCUTCHEON ADDED	PARTS LIST

Control Head with Dimmer Schematic Diagram
Used in 4-Frequency "Private-Line"
Tone-Coded Squelch "Motrac" and "Motran"
Radio Sets
Motorola No. 63D81000E02-01 (SMR-152B)
7/19/68-UP


TRANSMITTER
TRANSMITTER CHANNEL ELEMENTS LOCATED IN POWER SUPPLY
MODULATOR
1ST AMPLIFIER
1ST DOUBLER
2ND AMPLIFIER
1ST TRIPLER
2ND DOUBLER
2ND TRIPLER
POWER AMPLIFIER
HARMONIC FILTER
TDC AMPL
TRANSMITTER FILAMENTS
THIS SCHEMATIC DIAGRAM USED WITH RADIO SETS HAVING RECEIVERS SUFFIXED -1 OR EARLIER AND MODEL TLN8268A OR TLN8574A AUDIO BOARD.
EPD-16991-O
MICROPHONE CONTROL HEAD CABLING
"PRIVATE-LINE" TONE GENERATOR
("PRIVATE-LINE" MODELS ONLY)
POWER SUPPLY
PARTS LIST SHOWN ON BACK OF THIS DIAGRAM
450-470 MC, 20, 40 & 60 W, ±12 V
Multi-Frequency Operation
"Motrac" Radio Set with TLN8268A or TLN8574A Audio Board
Schematic and Intercabling Diagram
Motorola No. 63P81043A66-P1 (T-2486B)
(Sheet 2 of 2)
5/15/67-UP

THIS PARTS LIST USED WITH RADIO SETS HAVING RECEIVERS SUFFIXED -1 OR EARLIER AND MODEL TLN8268A OR TLN8574A AUDIO BOARD.

EPD-16990-O

TRANSMITTER

TLN8315A Transmitter Chassis Kit (406-420 MC)
TLN8316A Transmitter Chassis Kit (450-470 MC) EPD-15274-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf ±10%; 500 v; unl stated
C125	20C82984E01	var: 3-12; NP0 p/o L104
C127	20C82984E01	var: 3-12; NP0 p/o L105
C132	19C475605	var: 2.3-14.2; p/o L107
C134	19X859089	var: 2.7-6.75; p/o L108
C135	21B817745	620
C136	21C82187B07	470
C137, 145, 146, 148, 152, 153, 155, 156, 157, 159, 161, 162, 165, 170, 174, 176, 179, 181, 183, 198	21B861219	1000 GMV; coded RED
C138	21K850510	470; 300 v; p/o L104
C139	19X859089	var: 2.7-6.75; p/o L111
C140	21K848525	16 ±5%; NP0; p/o L106 (TLN8316A)
	or21K840365	24 ±5%; NP0 (TLN8315A)
C141	19B82475E01	var: 2.7-6.75
C142	21E847876	12 ±5%; NP0; p/o L105 (TLN8316A)
	or21K840849	20 ±5%; NP0 (TLN8315A)
C143	21C82187B07	470; p/o L105
C144	19X859089	var: 2.7-6.75; p/o L114
C147	19A820263	var: 1.7-8.7
C149	19B82550E01	var; 3-7
C150, 151	21K847087	220; 300 v; p/o L108
C154, 158, 160, 163	21C83191A01	1000 +100-0%
C164	21K851846	8 ±0.25 uuf; NP0 (TLN8316A only)
C166	1B82584E01	plate and screw assy; p/o L123
C167, 168	21C83805C01	1000 +100-0%; 1000 v
C169, 188	21C82880E17	7; 850 v
C171, 172, 175, 177, 180, 182, 184, 185, 186, 187	21B600801	1500
C173, 178, 199, 1001, 1002	21R410063	10 ±0.5 uuf; NP0
C1003	8D83987A02	c/o: 2 sect, 0.5 uf +80-20%; 1000 v
C1003A, B	21C82450B17	0.2 ±5%; (TLN8315A only)
C1015	21C82450B08	1.2 ±5%; (TLN8315A only)
C1016	21C82450B33	0.56 ±5% (TLN8315A only)
C1017		
J101	9C857358	CONNECTOR, receptacle: female; 12 cont.
J105	9C83663C01	female; single cont.
L[illegible]	24K859166	COIL, RF: 5.5 uh
L[illegible]	24V80901A76	plate coupling; incl, C125, 138, 140 (TLN8316A)
	or24V80902A15	plate coupling; incl, C125, 138, 140 (TLN8315A)
L[illegible]	24V80901A77	grid coupling; incl. C127, 142, 143 (TLN8316A)
	or24V80902A16	grid coupling; incl. C127, 142, 143 (TLN8315A)
L[illegible]	24D859162	choke; 1.2 uh
L[illegible]	24V80901A90	plate coupling; incl. C132
L[illegible]	24V80901A91	grid coupling; incl. C134, 150, 151 (TLN8316A)
	r24V80902A17	grid coupling; incl. C134, 150, 151, C1005 (TLN8315A)
L[illegible]	24A82998C01	choke; (TLN8315A)
L[illegible]	24A835456	choke; 0.32 uh; p/o L111
L[illegible]	24V80901A92	plate coupling; incl. C139, L110 (TLN8316A)
	r24V80902A18	plate coupling incl, C139, C1006, L110 (TLN8315A)
L112	24A82617E01	grid coupling
L113	24A82618E01	grid coupling
L114	24V80901A97	E.P.A. plate; incl. C144, L115
L115	24A835456	choke; 0.32 uh
L116	24A82604E01	E.P.A. coupling loop
L117	24A82797E01	P.A. grid coupling
L118	24A82796E01	P.A. grid tuning
L119	24A82794E01	P.A. grid tuning
L120, 121	24A82613G01	choke; 0.288 uh

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
L123	1V80758A41	P.A. plate tank; incl, C166 (TLN8316A)
	or1V80773A22	P.A. tank; incl. C166 (TLN8315A)
L124	24A82626E01	P.A. plate coupling (TLN8316A)
	or24B82580G03	P.A. plate coupling (TLN8315A)
L125 thru 130	24K858989	choke; 0.176 uh
L137	24K858989	choke; 0.176 uh (TLN8315A only)
P103, 104	28B82331G01	CONNECTOR, plug: male: single cont.
R114	6S6031	RESISTOR, fixed: ±10%; 1/2 w; unl stated 100K
R133	6S6022	330
R134	6S6434	27K
R135	6S5644	82K
R136, 140	6S129239	2, 7 meg; 1/4 w
R137	6S6320	10K
R138, 139	6S6074	68K
R141	6S5618	3.9K; 1 w
R142	6R4270	220
R143, 144	6S6397	22K
R145, 146	6S2073	2.2 meg ±5%
R147	6S6326	100
R148	6S5686	2.7K; 1 w
R149, 154	6S6446	4.7 meg
R150, 153	6S5410	33K
R151, 152	6S5591	18K
R155	6S6326	100 (TLN8316A only)
R156	18C83807C01	var: 5K; 12.5 w
R157	17C82177B02	32 ±5%; 5 w
R158	17R847359	2 ±2%; 1 w
R169	6S2080	470K; 2 w
R201	17D82177B15	4.5K; 7 w
V103	9SR319A01	ELECTRON TUBE: type 8077
V104	97R121A01	type 7551
V105, 106	97S113A01	type 6939
V107	97S136A02	type 8643
XV103, 104	9K858977	SOCKET, electron tube: female: 9 cont,
XV105, 106	9C82057E01	8 cont.
XV107	9B82264A01	7 cont.
Z105	1V80758A38	FILTER, harmonic: incl, P103, P104 (TLN8316A)
	or1V80731A35	incl. P103, P104 (TLN8315A)

MISCELLANEOUS

TKN6306A Intercabling Kit EPD-15532-O

J401	9A867432	CONNECTOR, receptacle: female; single contact
J402	28C802820	male; 19 contact
K401	80D83796G01	RELAY, armature: 13.5 v d-c; 1 form "C"

MISCELLANEOUS ITEMS

TGN6002A Front Panel Kit EPD-7863-A

NON-REFERENCED ITEMS		
	1V80716A04	PANEL & HANDLE ASSY.
	41A864597	SPRING, 2 req'd.
	55A852656	LOCK, incl.: 2-55K893872 KEYS

TLN6197A Heat Sink Kit EPD-13015-O

Q201 thru 206	48A124331	TRANSISTOR: (NOTE) P-N-P
NON-REFERENCED ITEM		
	15D82215A03	RADIATOR: 2 req'd

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

CABLE KIT

TKN6060A Cable Kit EPD-15302-O

F401	65B83578C01	FUSE, cartridge: 25 amp.; 32 v
F402	65B475247	6-1/4 a; 32 v
F403	65K86099	7. 5 a; 32 v
P402		CONNECTOR, plug: incl 9C801059 CONNECTOR, plug; 19 cont; female 15D82075D03 HOUSING, L, H, 15D82075D01 HOUSING, R, H, 3B131758 SCREW, 4-40 x 1-1/8", 2 req'd; 2S129924 NUT, hex 4-40 x 1/4"; 2 req'd 1V80717A73 SCREW and KNOB ASSY; 4A11722 WASHER, "C" 4A80671 WASHER, .016" thick 4A82113D01 WASHER, .032" thick; 42A864148 CLAMP, cable; 3S132127 SCREW, tapping: No. 6 x 3/4"; 2 req'd
W401	1V80703A59	CABLE ASSY: incl 30K812505 CABLE, power: 1 cond; No. 8 ga; str; RED, 22-1/2 ft. req'd; 29K824434 LUG, No. 10 incl 30K851875 CABLE, power: 1 cond; No. 8 ga; str; BLK; 5-1/2 ft. req'd; 29K847817 LUG for 3/8" stud
W402	1V80703A58	
W403	1V80705A19	incl 29K824455 LUG for No. 10 stud; 37C82603D64 SLEEVE, coded No. 20; 29A826D2D01 CONNECTOR, plug: 1 cont; ref part XF402
W404	1V80705A18	incl 29K865065 LUG for 3/8" stud; 37C82603D63 SLEEVE, coded No. 19; 29A826D2D01 CONNECTOR, plug: 1 cont; ref part XF403
W405	30C864650	CABLE, special purpose: 17 cond; 17 ft lgth req'd
XF401	67K892616	FUSEHOLDER: single fuse mounting
XF402	1V80705A07	incl 4AA82882A01 BODY, fuse-holder; 14A82883A01 CAP, fuseholder; 41A82885A01 SPRING, fuseholder; 1V80705A08 FUSE CLIP AND LEAD ASSY: incl 42AA82886A01 CLIP, fuse; 10M343 LEAD, elect.: 1 cond; No. 18 ga; str; ORG; 57": req'd; 1V80705A09 FUSE CLIP AND LEAD ASSY: incl 42AA82886A01 CLIP, fuse 10M343 LEAD, elect.: 1 cond; No. 18 ga; str; ORG; 9" req'd ref part F402
XF403	1V80705A10	incl 14AA82882A01 BODY, fuse-holder; 14A82883A01 CAP, fuseholder; 41A82885A01 SPRING, fuseholder; 1V80705A11 FUSE CLIP AND LEAD ASSY: incl 42AA82886A01 CLIP, fuse; 10M345 LEAD, elect.: 1 cond; No. 18 ga; str; GRN; 97": req'd; 1V80705A12 FUSE CLIP AND LEAD ASSY: incl 42AA82886A01 CLIP, fuse 10M345 LEAD, elect.: 1 cond; No. 18 ga; str; GRN; 9" req'd ref part F403

NON-REFERENCED ITEMS		
	29A82602D01	CONNECTOR, plug: male; single cont; 19 req'd; SLEEVE, coded:
	37B82603D01	1
	37B82603D02	2
	37B82603D03	3
	37B82603D04	4
	37B82603D05	5
	37B82603D06	6
	37B82603D07	7
	37B82603D08	8
	37B82603D09	9
	37B82603D10	10
	37B82603D11	11
	37B82603D12	12
	37B82603D13	13
	37B82603D14	14
	37B82603D15	15
	37B82603D16	16
	37B82603D17	17
	37B82603D18	18
	37B82603D21	21

CONTROL HEAD

TGN6026AJ Control Head, Trunk Mount (Std. Squelch)
TGN6026AK Control Head, Trunk Mount (Dual Squelch) EPD-14829-O

DS501, 502	65R4151	LAMP, incandescent: 0.2 amp.; type #51
J501	9K830418	CONNECTOR, receptacle: female; 4 contact
R501, 502	17C82350A04	RESISTOR, fixed: ±10%; unl. stated 33; 2 w
R503	18K857840	var. 25K ±30%
R504	6R3581	3.3K; 1/2 w
R505	6R6320	10K; 1/2 w
R506	18K868896	var.; 25K ±30%; 0.33 w; incl. S501 (TCN6026AJ)
	or 18K857698	var.; 25K ±30%; 0.16 w (TCN6026AK)
R507	6R6336	270; 1 w
S501		SWITCH, rotary: unl. stated dpst; p/o R506 (TCN6026AJ)
S502	or 40K80247	toggle; dpst (TCN6026AK)
S503	40C83624D01	1 pole; 4 pos.
	40A80246	toggle; dpdt
TB501	31C857699	BOARD, terminal: 35 female contacts
XDS501, 502	9B863168	LAMPHOLDER: single contact; bayonet base

NON-REFERENCED ITEMS		
	61A865158	LENS, red
	61K865159	LENS, grn
	2A48070	NUT, knurled: 13/64"-27 x 1/8"
	3AB2670A01	SCREW, machine; #6-32 x 1.44" (2 req'd)
	36K858652	KNOB, vol. control (2 req'd)
	36B82869D02	KNOB, freq. selector

MICROPHONE

TMN6013A Microphone
TMN6018A Microphone Weatherproof EPD-9938-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
DP601	59D82933C01	CARTRIDGE, microphone: transistor amplifier
P601	28A16370	CONNECTOR, plug: male; 4 contact
S601	40C82263G02 (TMN6013A) or40C82263G21 (TMN6018A)	SWITCH, push: dpst (not replaceable in TMN6018A)
W601	1V80707A58 (TMN6013A)	CORD, microphone: assembly; incl. P601 and the following items: 41A85270 SPRING, strain relief 29A847034 LUG, insulation-piercing; 4 req'd.
	or1V80724A28 (TMN6018A)	CORE, PLUG & SWITCH ASSY, incl. P601, S601
NON-REFERENCED ITEMS		
	1V80720A94	CASE, microphone, incl. hang-up stud (TMN6013A & TMN6018A)
	11M2506	TUBING; No. 9 BLK, 5" length req'd.
	3S126693	LOCKSCREW: 6-32 x 1/4" Phillips round head; 2 req'd.
	42A852710	STRAP, strain relief
	3BA852699	PUSHBUTTON
	15D82701B01	COVER, microphone case (front) (TMN6013A & TMN6018A)
	32A82703B01	GASKET: neoprene
	4S114201	WASHER: 1/4" x 0.156" x .015, 3 req'd.
	3S127924	LOCKSCREW: 6-32 x 5/16" Phillips round head
	3S132436	SCREW, machine: 6-32 x 13/16" Phillips round head 3 req'd.
	42B82702B01	RETAINER, mic. cartridge
	1V86539B	MOUNTING KIT, microphone incl. 64A8559x PLATE mic. hang-up; 3S122830 SCREW, tapping: No. 8 x 1/2" slotted hinder head, 2 req'd.

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

A. TEST EQUIPMENT REQUIRED

1. Motorola Model S1056A-9A Portable Test Set with a Motorola Model TKN6025A Adapter Cable (available on separate order) must be used. A 0-50 microampere meter with 20,000 ohms equivalent series resistance may be used if a test set is not available.
2. Motorola Model T1034C Signal Generator (or equivalent).
3. Motorola Model TLN6845A Tuning Tool Kit. A small screwdriver may be used for some of the alignments.
4. Motorola Model T1012A Power Supply (or equivalent).

B. HOW TO SET UP THE S1056A-9A PORTABLE TEST SET

1. Set function selector switch to RCVR position.
2. Switch on 455 kc crystal oscillator.
3. Connect the 20-pin meter cable plug to the test set; connect the adapter cable to the cable coming from the test set; connect the other end of the adapter cable to the receiver metering socket. When the test set is not in use; disconnect the 20-pin metering cable to conserve internal battery life. The plug on the cable acts as an on-off switch completing the battery circuit.
4. Connect the r-f extension cable to the test set; connect the r-f probe cable to the r-f extension cable.

C. HOW TO SET UP THE SIGNAL GENERATOR FOR 8 MC IF ALIGNMENT

1. Set up the signal generator according to the instructions supplied with the unit.
2. Remove the first oscillator channel element(s).
3. Connect the signal through a 0.003 uf capacitor to POINT 2 (8 mc i-f amplifier) as shown on the photo. (Generator output cable terminated in 50 ohms.)
4. Switch the test set to meter position 4.
5. Rotate the signal generator dial back and forth near the 8 mc reading. Watch the test set meter. The pointer should swing above and below the zero reading as the dial is rotated. Set the dial to absolute zero meter reading.

D. HOW TO SET UP THE SIGNAL GENERATOR FOR RF ALIGNMENT

1. Set up the signal generator according to the instructions supplied with the unit.
2. Connect the signal generator cable to the antenna input.
3. Turn the generator output up to maximum.
4. Keep the test set in position 4.
5. Rotate the signal generator dial back and forth near the assigned r-f carrier frequency. Watch the test set meter. The pointer should swing above and below the zero reading as the dial is rotated. Set the dial for exact zero meter reading. Be sure the generator frequency is kept at zero meter reading.

E. HOW TO MEASURE 20 DB QUIETING SENSITIVITY

Test Equipment Required

1. Motorola Model T1034C Signal Generator
2. Motorola Model S1056A-9A

Procedure

1. Turn on the signal generator and allow it to warm up for at least one hour.
2. Connect the meter cable from the test set to the receiver METER receptacle on the chassis.
3. Set the RCVR-XMTR-ACCESS switch to the RCVR position. Set the position selector to position 4.
4. Connect the signal generator output through a 6 db pad to the ANT jack on the radio set.
5. Turn up the generator output and rotate the generator dial back and forth near the assigned r-f carrier frequency. The test set meter pointer should swing above and below the zero mark as the generator dial is rotated. Set the dial for exact zero reading.
6. Reduce the signal generator output to zero (i.e., no signal input). Set the position selector switch to position 11 (AUDIO).
7. Unsquelch the receiver by turning the control head SQUELCH control fully counterclockwise.
8. Adjust the VOLUME control, located on the control head, for a 1.0 volt reading on the test set meter.
9. Now, turn up the signal generator output until the test set meter reading drops to 0.1 volt. Note the setting of the signal generator output control. This value (less 6 db for the attenuation of the pad) in microvolts is the 20 db quieting sensitivity for the receiver.

F. TEST SET SELECTOR SWITCH POSITIONS

S1056A-9A TEST SET	1	2	4	5	6	11
CIRCUIT METERED	455 KC IF Ampl. #1	455 KC IF Ampl. #3	Discrim. Secondary	Discrim. Primary	1st. Osc.	Audio

G. FREQUENCY CALCULATIONS

$$f_{o1} = \frac{f_c - 8\ MC}{27}$$

where: f_{o1} = 1st oscillator crystal frequency

f_c = carrier frequency

TUNING TOOLS

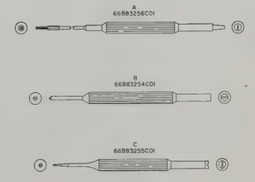
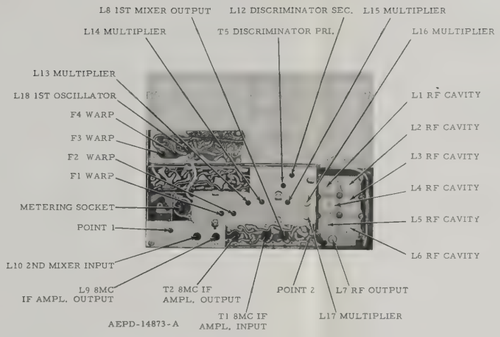


DIAGRAM NO. EEPD-13524-O



AEPD-14873-A

AVERAGE STAGE MEASUREMENTS ON REVERSE SIDE OF THIS SHEET

H. RECEIVER ALIGNMENT

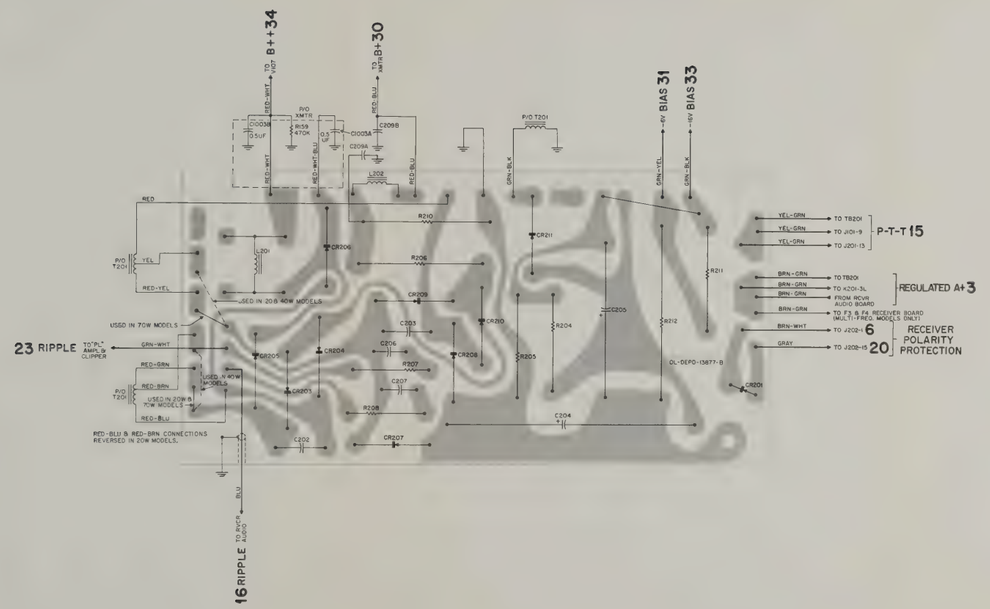
STEP	STAGE AND PROCEDURE
1	DISCRIMINATOR PRIMARY -- Set up the test set as described in paragraph B at the left Insert a 2 uuf capacitor in series with the r-f probe. Place the r-f probe on the input to the 455 kc i-f filter (POINT 1). Adjust L12 so that the slug is very close to the top of the coil. Adjust T5 for a maximum indication on the test set meter in position 5. Use screwdriver end of tuning tool B.
2	DISCRIMINATOR SECONDARY -- Use the "0" center scale on the test set. Adjust L12 for absolute zero on the "0" center (top) scale with the switch in position 4. Use screwdriver end of tuning tool B. This is a critical adjustment and should be exactly on zero. Remove the r-f probe
3	8 MC IF -- Set up the test equipment as described in paragraph C at the left of this page Use the minimum 8 mc signal that will produce a linear increase in test set meter reading with an increase in signal strength (selector switch in position 1). Tune L10, L9, T2, T1 and L8 in that order, for a maximum test set meter indication with the selector switch in position 1. Use the wide screwdriver end of tuning tool C. Replace the first oscillator after channel element(s) after alignment is completed.
4	FIRST OSCILLATOR -- Uncouple the signal generator. Adjust coils L13 and L14 for maximum meter indication in position 6. Use hex end of tuning tool A. On multiple frequency receivers, set the frequency selector switch to the F3 or F4 position and adjust coil L18 for maximum meter indication in position 6.
5	ON-FREQUENCY ADJUSTMENT -- Transmit a carrier from the transmitter which this receiver is normally intended to receive. If the "Motrac" transmitter and receiver are on the same frequency and if the transmitter is known to be "on-frequency" connect the antenna to the radio set antenna connector, and short the KEY contact located on the exciter board. This allows the transmitter to be heard in the receiver and an external transmitter is not required. Listen for quieting of noise at the test set speaker. Test set position 1 should indicate a rise when the transmitter is "on". Check the meter indication in position 4; zero indicates 'on-frequency'. Set F1 "warp" capacitor for exact "0" center meter indication. On multiple frequency receivers adjust F2, F3, and F4 "warp" capacitors for the corresponding frequency.
6	MULTIPLIER -- Set up the signal generator as described in paragraph D at the left. Apply as much signal as is necessary for a small indication in meter position 1. Align coil L15 (use hex end of tuning tool A) and coils L16, L17 (use screwdriver end of tuning tool C) for maximum in position 1.
7	RF DECK -- Set up the signal generator as described in paragraph D at the left. Apply as much signal as is necessary for a small indication in meter position 1. If no indication can be obtained in meter position 1, adjust slugs L1 through L6 flush with the top of the r-f casting and turn slug L7 three turns from the bottom. Use screwdriver end of tuning tool C. Tune L1 through L6 clockwise 1/2 turn until a reading in meter position 1 is obtained. Tune L1, L2, L3, L4, L5, L6 and L7, in that order, for maximum in meter position 1. Reduce generator output as required. Continue the above procedure until all slugs are tuned for maximum in meter position 1. Turn L1 through L6 counterclockwise 1/4 turn. Set the signal generator output for a reading of about 15 ua on position 1 and repeak twice L1 through L7, in that order, for maximum in meter position 1

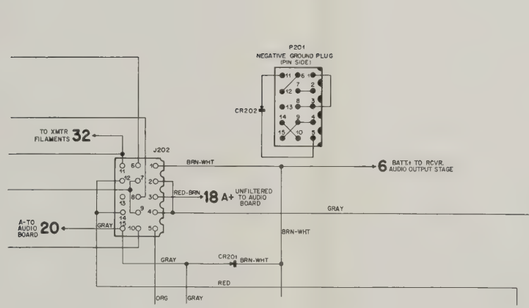
I. AVERAGE STAGE MEASUREMENTS WITH THE RADIO SET PROPERLY ADJUSTED

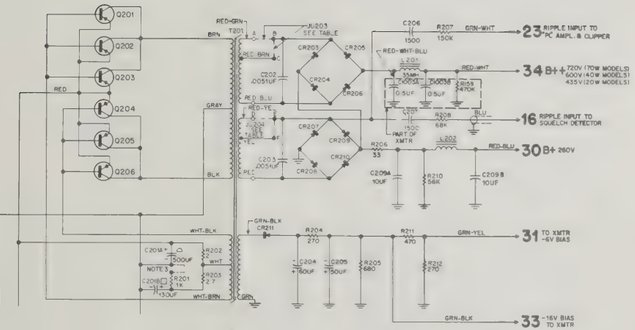
APPROXIMATE MICROVOLT INPUT	INPUT TO		FREQUENCY	METER POSITION	TEST SET METER READING
No Signal	Antenna Disconnected			1	2.0 ua
No Signal	Antenna Disconnected			2	20 ua
No Signal	Antenna Disconnected			4	0
No Signal	Antenna Disconnected			5	15 ua
No Signal	Antenna Disconnected			6	10 ua
0.5	Antenna Connector		Carrier Freq.		20 DB Quieting
0.6	Antenna Connector		Carrier Freq.	1	15 ua
0.5	Base	1st Mixer (Q2)	Carrier Freq.		20 DB Quieting
140	Collector		8 mc	1	15 ua
12.5	Base	8 mc IF Transistor (Q3)	8 mc	1	15 ua
180	Collector				
8.0	Base	2nd Mixer (Q4)	8 mc	1	15 ua
250	Collector		0.455 mc	1	15 ua
110	Base	455 kc Ampl. Transistor (Q5) in 455 kc filter	0.455 mc	1	15 ua
2200	Collector				
1600	Base	1st 455 kc IF Transistor (Q6)	0.455 mc	1	15 ua
60000	Collector				

STAGE MEASUREMENT NOTES

1. All measurements made with signal generator tuned to the required frequency.
2. All measurements, except antenna input, taken with 50 ohm terminated cable with a 0.003 uf capacitor in series.
3. First mixer quieting is measured with the r-f coax input lead to the 8 mc i-f strip disconnected.







PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Power Supply Rectifier and Filter Circuit Board Detail
Models TLN8319A and TLN8320A, 450-470 MC
"Motrac" Radio Sets
Motorola No. EPD-13878-A (T-2309C)
7/19/66-UP

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TLN8319A	C209A	ADDED ADDED 20 WATT CONNECTIONS	JUNCTION L202, R206 AND R210

PARTS LIST

TLN8319A Power Supply Chassis Ass'y — EPD-14223-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C201 C201A C201B	23D82125B15	CAPACITOR, fixed: consists of 2 sections: 500 uf +100-10%; 25 v 130 uf +50-0%; 25 v
C209 C209A, B	23D82393A04	consists of 2 sections: 10 uf; 375 v
J202		CONNECTOR, receptacle: female; incl. 14C82338A02 INSULATOR 15 circuit; 1V80755A14 ASS'Y term. & pin, large type (4 req'd); 1V80761A91 ASS'Y term & pin small type (5 req'd)
L202	25B82878A07	COIL, AF: choke; 70 mh
R201	6S6327	RESISTOR, fixed: 1K ±10%; 1 w
R202	17C82381A13	2 ±5%; 20 w
R203	17K892226	2.7 ±5%; 1/2 w
R209	17C82177B15	4.5K ±10%; 7 w
TB201	1V80761A89	BOARD, terminal: ASS'Y; 10 lug riveted

TLN8320A Rectifier and Filter Board — EPD-14224-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C202, 203	21D82428B55	CAPACITOR, fixed: uf .0051 ±10%; 2000 v
C204	23D82601A29	60 +150-10%; 50 v
C205	23D82601A36	50 +150-10%; 35 v
C206, 207	21D82428B38	.0015 +10-0%; 500 v
CR201	48C82525G05	SEMICONDUCTOR DEVICE, diode: (SEE NOTE) silicon
CR203, 204, 205, 206	48C82466H18	silicon
CR207, 208, 209, 210	48C82466H16	silicon
CR211	48C82466H12	silicon
L201	25C83124C01	COIL, AF: choke; 35 mh
		RESISTOR, fixed: ±10%; 1 w; unl. stated
R204, 212	6S6336	270
R205	6S5594	680
R206	17C82177B02	33 ±5%; 5 w
R207	6R6398	150K; 1/2 w
R208	6S6074	68K; 1/2 w
R210	6S5592	56K; 2 w
R211	6S5593	470

TLN8321A Relay Kit — EPD-14225-O

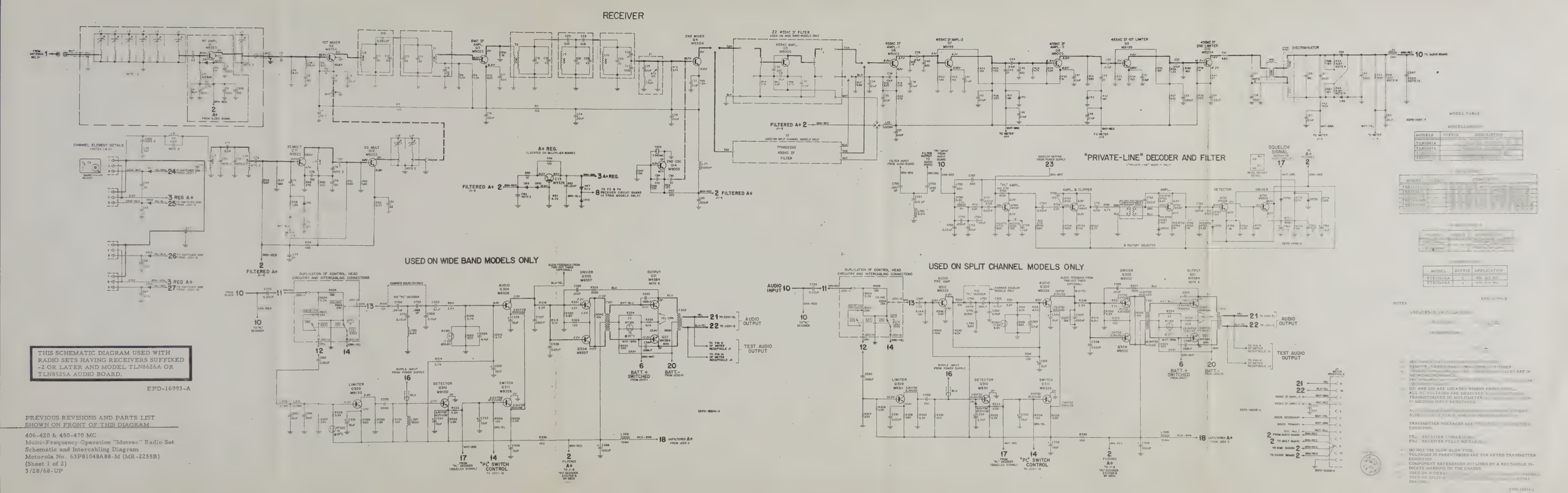
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
K201	80D83755C01	RELAY, armature: left stack; 1 form "C"; 1 form "B"; right stack; 1 form "A"; coil res. 80 ohms; 9 v

TLN8322A Transformer Kit — EPD-14226-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
T201	25D83756C01	TRANSFORMER, power: pri no. 1: BRN, BLK with GRAY tap total res .0158 ohms pri no. 2: WHT-BLK, WHT-BRN with WHT tap total res .03 ohms sec no. 1: RED-BLU, RED-GRN with RED-BRN tap; coil res 6.7 ohms sec no. 2: RED, RED-YEL with YEL tap coil res 4 ohms sec no. 3: GRN-BLK, GRN res 0.5 ohms
NON-REFERENCED ITEM		
	29K865067	LUG, ring tongue (2 req'd)

NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.


RECEIVER
USED ON WIDE BAND MODELS ONLY
USED ON SPLIT CHANNEL MODELS ONLY
"PRIVATE-LINE" DECODER AND FILTER
THIS SCHEMATIC DIAGRAM USED WITH RADIO SETS HAVING RECEIVERS SUFFIXED -2 OR LATER AND MODEL TLN8626A OR TLN8525A AUDIO BOARD.
EPD-16993-A
PREVIOUS REVISIONS AND PARTS LIST SHOWN ON FRONT OF THIS DIAGRAM
406-420 & 450-470 MC
Multi-Frequency Operation "Motrac" Radio Set
Schematic and Intercabling Diagram
Motorola No. 63P81048A88-M (MR-2255B)
(Sheet 1 of 2)
3/28/68-UP
MODEL TABLE
MISCELLANEOUS
MODEL
SUFFIX
DESCRIPTION
TLN1081A
TLN1091A
TRE1112
TRE1112AD
TRE1112AC
MODEL
SUFFIX
APPLICATION
TTE1013AA
2
406-420 MC
TTE1012AA
J
470-494 MC
NOTES
EPD-16993-D
EPD-16804-A
EPD-16805-A
EPD-16806-G
EPD-16806-C
EPD-16496-E

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION	REFER TO CIRCUIT BOARD
A	TLN8307A-1 TLN8307AH-1				8 MC IF BD. EPD-13788-B
B	TLN8308A-1				455 KC BD. EPD-13858-B
C	TLN8308A-2				455 KC BD. EPD-13858-C
D	TLN8513A-1 TLN8525A-1				AUDIO & SQ. BD PEPD-16965-A
D1	TLN8270AA				"PL" DECODER BD. EPD-13875-E
D2	TLN8315A TLN8316A	V107	WAS 97S136A02	XMTR PA	
E	TLN8324A-2				F3 & F4 RCVR. BD.
E1	TLE6154A TLN8312A TLN8315A TLN8626A		ADDED	PARTS LIST & SCHEMATIC	
F	TLN8530A-1				CHANNEL ELEMENT BD. EPD-15381-B
	TLE6156A-1 TLE6157A-1				EXCITER BD. EPD-13718-C
G	TLN8578A-3				455 KC BD. EPD-13858-E
H	TLE6156A-2				EXCITER BD. EPD-13718-D
H1	TLN8317A				IDC CIRCUIT EPD-13721-A
J	TLN8312A-1	L16	WAS 24B82051E03 (406-420 MC)	PARTS LIST	NONE
		L17	WAS 24B83814C02 (406-420 MC)		
K	TTE1061AA-1 TTE1062AA-2	V103	WAS 95R319A01, TYPE 8077	1ST. TRIPLER	NONE
L	TLN8626A-2				AUDIO & SQ BD. PEPD-18176-A
M	TTE1061AA-2 TTE1062AA-3	C149	WAS 19B82550E01, 3-7 uuf	P.A. INPUT	NONE

PARTS LIST

PARTS LISTS FOR PRINTED CIRCUIT BOARDS ARE ON THE BACK OF THE CORRESPONDING PRINTED CIRCUIT BOARD DETAILS

RECEIVER

TLE6154A RF Deck (406-420 MC)
TLE6155A RF Deck (450-470 MC) EPD-14197-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1	21D82355B05	22 uuf ±5%; 500 v; N330
C2, 3, 4	21C83191A01	1000 uuf +100-0%; 500 v
C308	21K863801	250 uuf ±10%; 350 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1	48B83829D01	germanium: p/o L6
		COIL, RF:
L1	24V80905A31	incl. 24B83767C03 COIL, 3 turn, tapped (TLE6155A)
	or24V80906A18	incl. 24B83767C03 COIL, 3 turn, tapped (TLE6154A)
L2, 3, 4, 5	24V80905A23	incl. 24B83767C01 COIL, 3 turn, (TLE6155A)
	or24V80906A16	incl. 24B83767C01 COIL, 3 turn, (TLE6154A)
L6	24V80905A22	incl. 24B83767C03 COIL, 3 turn, tapped; CR1 (TLE6155A)
	or24V80906A15	incl. 24B83767C03 COIL, 3 turn, tapped (TLE6154A)
L7	24V80905A24	incl. 24B83770C01 COIL, 5-1/2 turn (TLE6155A)
	or24V80906A17	incl. 24B83770C03 COIL, 3 turn, (TLE6154A)
L11	24V80905A25	choke; 0.29 uh
		TRANSISTOR: (SEE NOTE)
Q1	48R869353	P-N-P; type M9353
		RESISTOR, fixed: ±10%; 1/4 w
R1	6S128686	8.2K; ampl.
R2	6S128688	2.7K; ampl.
R3	6S127802	1K; ampl.
		NON-REFERENCED ITEMS
	1V80758A52	ASSY. RF AMPL; incl. C1, C2, C3, C4, L11, Q1, R1, R2, R3, R4
	76B83776C03	CORE, tuning (used with L1, L2, L3, L4, L5, L6)
	1B83244G01	CORE, tuning (used with L7)

TLN8310A Metering Socket & Cable (Carrier S9)
TLN6528A Metering Socket & Cable
("PL" Tone-Coded Squelch) EPD-15528-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C306	21K800801	CAPACITOR, fixed: 1500 uuf +100-0%; 500 v
J1	9C857358	CONNECTOR, receptacle: female; 12 contact

IF Filter EPD-15526-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Z2	TFN6017AW	bandpass; includes 1V80738A21 Amplifier Circuit Board Assembly (see detail EPD-9433)

IF Filter EPD-18425-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Z2	TFN6022AS	bandpass; amplifier circuit board assembly used on split-channel spacing models only

TLN8305A Receiver Chassis Kit EPD-14199-B

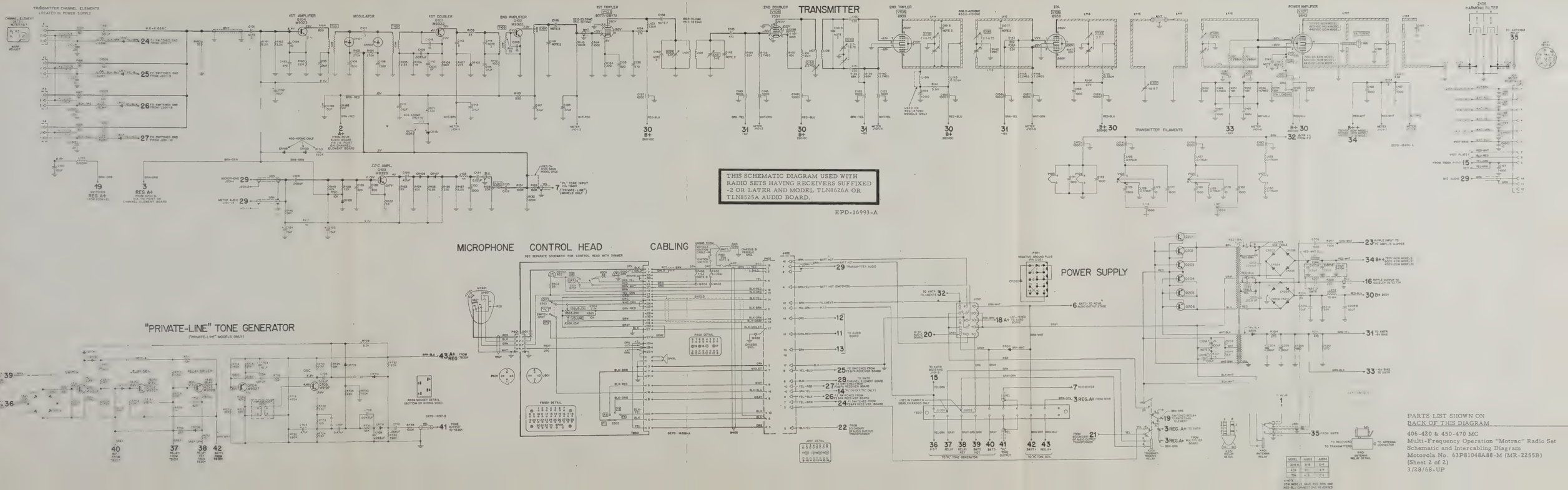
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q21, 22	48S134584	TRANSISTOR (SEE NOTE) P-N-P; coded WHT-GRN
T6	25C82061H02	TRANSFORMER, audio: pri: PINS 1 & 3 with C. T. @ PIN 2 total coil res 0.5 ohms sec: PINS 4 & 5 coil res 0.2 ohms
XQ21, 22	9B851303	SOCKET, transistor: female; 2 contact
		NON-REFERENCED ITEM
		INSULATOR, transistor (used with Q21, Q22)

TLN8312A Oscillator Cavity Kit (406-420 MC)
TLN8314A Oscillator Cavity Kit (450-470 MC) EPD-14200-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		COIL, RF:
L16	24B83814C02	injection (406-420 mc)
	or24B83814C01	injection (450-470 mc)
L17	24B82051E05	injection (406-420 mc)
	or24B82051E03	injection (450-470 mc)
		NON-REFERENCED ITEMS
	15D83664C01	HOUSING, oscillator injection
	1V80722A32	ASSY, TOP PLATE
	29B82030E01	LUG, feed-thru (2 req'd.)
	3A824386	SCREW, flat head, 4-40 (2 req'd)

THIS PARTS LIST USED WITH RADIO SETS HAVING RECEIVERS SUFFIXED -2 OR LATER AND MODEL TLN8626A OR TLN8525A AUDIO BOARD.

EPD-16992-A


TRANSMITTER
TRANSMITTER CHANNEL ELEMENTS LOCATED IN POWER SUPPLY
1ST AMPLIFIER
MODULATOR
1ST DOUBLER
2ND AMPLIFIER
1ST TRIPLER
2ND DOUBLER
2ND TRIPLER
406.0-430.0MC
450.0-470.0MC
POWER AMPLIFIER
Z105 HARMONIC FILTER
TRANSMITTER FILAMENTS
THIS SCHEMATIC DIAGRAM USED WITH RADIO SETS HAVING RECEIVERS SUFFIXED -2 OR LATER AND MODEL TLN8626A OR TLN8525A AUDIO BOARD.
EPD-16993-A
MICROPHONE CONTROL HEAD CABLING
SEE SEPARATE SCHEMATIC FOR CONTROL HEAD WITH DIMMER
POWER SUPPLY
"PRIVATE-LINE" TONE GENERATOR
("PRIVATE-LINE" MODELS ONLY)
PARTS LIST SHOWN ON BACK OF THIS DIAGRAM
406-420 & 450-470 MC
Multi-Frequency Operation "Motrac" Radio Set
Schematic and Intercabling Diagram
Motorola No. 63P81048A88-M (MR-2255B)
(Sheet 2 of 2)
3/28/68-UP

THIS PARTS LIST USED WITH RADIO SETS HAVING RECEIVERS SUFFIXED -2 OR LATER AND MODEL TLN8626A OR TLN8525A AUDIO BOARD.

EPD-16992-A

TRANSMITTER

TLN8890A Transmitter Chassis Kit (406-420 MC)
TLN8891A Transmitter Chassis Kit (450-470 MC)
TLN8315A Transmitter Chassis Kit (406-420 MC)
TLN8316A Transmitter Chassis Kit (450-470 MC) EPD-15274-F

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: unf ±10%: 500 v, unl stated
C125	20C82984E01	var: 3-12; NP0 p/o L104
C127	20C82984E01	var: 3-12; NP0 p/o L105
C132	19C475605	var: 2.3-14.2; p/o L107
C134	19K859089	var: 2.7-6.75; p/o L108
C135	21B837745	820
C136	21C82187B07	470
C137, 145, 146, 148, 152, 153, 155, 156, 157, 159, 161, 162, 165, 170, 174, 176, 179, 181, 183, 198	21B861219	1000 GMV; coded RED
C138	21K850510	470, 300 v; p/o L104
C139	19K859089	var: 2.7-6.75; p/o L111
C140	21K848525	16 ±5%; NP0; p/o L104 (TLN8316A, TLN8891A)
	or21K840365	24 ±5%; NP0 (TLN8315A, TLN8890A)
C141	19B82475E01	var: 2.7-6.75
C142	21K847874	12 ±5%; NP0; p/o L105 (TLN8316A, TLN8891A)
	or21K840849	20 ±5%; NP0 (TLN8315A, TLN8891A)
C143	21C82187B07	470; p/o L105
C144	19K859089	var: 2.7-6.75; p/o L114
C147	19A820263	var: 1.7-8.7
C149	19B82550E03	var: 1.8-4.5 unf: 850 v
C150, 151	21K847087	220; 300 v; p/o L108
C154, 158, 160, 163	21C83119A01	1000 +100-0%
C164	21K851846	8 ±0.25 uuf; NP0 (TLN8316A, TLN8891A)
C166	1B82584E01	plate and screw assy; p/o L123
C167, 168	21C83805C01	1000 -100-0%; 100 v
C169, 188	21C82880E17	7; 850 v
C171, 172, 175, 177, 180, 182, 184, 185, 186, 187	21B800801	1500
C173, 178, 199, 1001, 1002	21R410063	10 ±0.5 uuf, NP0
C1003	8D83987A02	c/o: 2 sect.
C1003A, B		0.5 uf +80-20%; 1000 v
C1015	21C82450B17	2.2 ±5%; (TLN8315A, TLN8890A)
C1016	21C82450B08	1.2 ±5%, (TLN8315A, TLN8890A)
C1017	21C82450B33	0.56 ±5%; (TLN8315A, TLN8890A)
		CONNECTOR, receptacle: female; 12 cont.
J101	9C857358	female; single cont.
J105	9C83663C01	
		COIL, RF: 7.3 uh
L103	24K859166	plate coupling; incl. C125, 138, 140 (TLN8316A, TLN8891A)
L104	24V80901A76	
	or24V80902A15	plate coupling; incl. C125, 138, 140 (TLN8315A, TLN8890A)
L105	24V80901A77	grid coupling; incl. C127, 142, 143 (TLN8316A, TLN8891A)
	or24V80902A14	grid coupling; incl. C127, 142, 143 (TLN8315A, TLN8890A)
L106	24D859162	choke; 1.2 uh
L107	24V80901A90	plate coupling; incl. C132
L108	24V80901A91	grid coupling; incl. C134, 150, 151 (TLN8316A, TLN8891A)
	or24V80902A17	grid coupling; incl. C134, 150, 151, C1005 (TLN8315A, TLN8890A)
L109	24A82998G01	choke; (TLN8315A, TLN8890A)
L110	24A835456	choke; 0.32 uh; p/o L111
L111	24V80901A92	plate coupling; incl. C139, L110 (TLN8316A, TLN8891A)
	or24V80902A18	plate coupling incl. C139, C1006, L110 (TLN8315A, TLN8890A)
L112	24A82617E01	grid coupling
L113	24A82618E01	grid coupling
L114	24V80901A97	L.P.A. plate; incl. C144, L115
L115	25A835456	choke; 0.32 uh
L116	24A82604E01	L.P.A. coupling loop
L117	24A82797E01	P.A. grid coupling
L118	24A82796E01	P.A. grid tuning
L119	24A82794E01	P.A. grid tuning
L120, 121	24B82613G01	choke. 0.288 uh
L123		P.A. plate tank; incl. C166 (TLN8316A, TLN8891A)
	or1V80773A22	P.A. tank; incl. C166 (TLN8315A, TLN8890A)
L124	24A82626E01	P.A. plate coupling (TLN8316A, TLN8891A)
	or24B82580G01	P.A. plate coupling (TLN8315A, TLN8890A)
L125 thru 130	24K858989	choke. 0.176 uh
L137	24K858989	choke; 0.176 uh (TLN8315A, TLN8890A)
		CONNECTOR, plug: male, single cont.
P103, 104	28B82331G01	
		RESISTOR, fixed: ±10%; 1/2 w unl stated
R114	6S6031	100K
R133	6S6022	330
R134	6S6434	27K
R135	6S5644	82K
R136, 140	6S129239	2.7 meg. 1/4 w
R137	6S632	10K
R138, 139	6S6074	68K
R141	6S5618	3.9K. 1 w
R142	6R6270	220
R143, 144	6S6397	22K
R145, 146	6S2073	2.2 meg ±5%
R147	6S6326	100
R148	6S5686	2.7K. 1 w
R149, 154	6S6446	4.7 meg
R150, 153	6S5410	33K
R151, 152	6S5591	180
R155	6S6326	100 (TLN8316A, TLN8891A)
R156	18C83807C01	var: 5K. 12.5 w
R157	17C82177B02	32 ±5%. 5 w
R158	17K847359	2 ±2%. 1 w
R169	6S2080	470K. 2 w
R201	17D82177B15	4.5K. 7 w
		ELECTRON TUBE:
V103	65A83735A02	type 12BY7
	or9S5164A02	type 12BY7A
V104	9TR121A01	type 7551
V105, 106	9T5113A01	type 6939
V107	9T5136A02	type 8643 (TLN8315A, TLN8316A)
	or9T5136A01	type 8643 (TLN8890A, TLN8891A)
		SOCKET, electron tube: female.
XV103, 104	9K858977	9 cont.
XV105, 106	9C82057E01	8 cont.
XV107	9B82264A01	7 cont.
		FILTER, harmonic: incl. P103, P104 (TLN8316A, TLN8891A)
Z105	1V80758A38	
	or1V80731A35	incl. P103, P104 (TLN8315A, TLN8890A)

TLN8708A Heat Sink Kit
TLN6197A Heat Sink Kit EPD-13015-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q201 thru 206	48A124331	TRANSISTOR: (NOTE) P-N-P
NON-REFERENCED ITEM		
	15D82215A03	RADIATOR: 2 req'd (TLN6197A)
	15D82132D07	RADIATOR: 2 req'd (TLN8708A)

MISCELLANEOUS

TKN6315A Intercabling Kit EPD-16973-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
J401	9C82442E06	CONNECTOR, receptacle: female; single contact
J402	28C802820	male; 19 contact
K401	80D83796C02	RELAY, armature: 13.5 v dc; 1 form "C"

Channel Element EPD-14785-A

	TLN1083A	Transmitter Control: ±0.0005% frequency stability
	orTLN1087A	Transmitter Control: ±0.0002% frequency stability

MISCELLANEOUS ITEMS

TGM6002A Front Panel Kit EPD-7863-A

NON-REFERENCED ITEMS		
	1V80716A04	PANEL & HANDLE ASSY.
	41A804597	SPRING, 2 req'd.
	55A852656	LOCK, incl.; 2-55K893872 KEYS

CABLE KIT

TKN6040A Cable Kit EPD-15302-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
F401	65B83578C01	FUSE, cartridge: 35 amp.; 32 v
F402	65B475247	6-1/4 a; 32 v
F403	65K86099	7.5 a; 32 v
P402		CONNECTOR, plug: incl 9C801050 CONNECTOR, plug: 19 cont; female
	15D82075D03	HOUSING, L. H.
	15D82075D01	HOUSING, R. H.
	3S131758	SCREW, 4-40 x 1-1/8", 2 req'd; 2S129924
		NUT, hex 4-40 x 1/4"; 2 req'd
	1V80717A73	SCREW and KNOB ASS'; 4A11722 WASHER, "C" 4A800671 WASHER, .016" thick 4A82113D01 WASHER, .032" thick; 42A864148 CLAMP, cable; 3S132127 SCREW, tapping: No. 6 x 3/4"; 2 req'd
W401	1V80703A59	CABLE ASSY: incl 30K821505 CABLE, power: 1 cond; No. 8 ga; str; RED; 22-1/2 ft. req'd; 29K824434 LUG; No. 10
W402	1V80703A58	incl 30K851875 CABLE, power: 1 cond; No. 8 ga; str; BLK; 5-1/2 ft. req'd; 29K847817 LUG for 3/8" stud
W403	1V80705A19	incl 29K824456 LUG for No. 10 stud; 37C82603D64 SLEEVE, coded No. 20; 29A826022D1 CONNECTOR, plug: 1 cont; ref part XF402
W404	1V80705A18	incl 29K865065 LUG for 3/8" stud; 37C82603D63 SLEEVE, coded No. 19; 29A826021D1 CONNECTOR, plug: 1 cont; ref part XF403
W405	30C864650	CABLE, special purpose: 17 cond; 17 ft lgth req'd
XF401	67K892616	FUSEHOLDER: single fuse mounting
XF402	1V80705A07	incl 14A82882A01 BODY, fuseholder; 14A82883A01 CAP, fuseholder; 41A82885A01 SPRING, fuseholder; 1V80705A08 FUSE CLIP AND LEAD ASS'; incl 42A82884A01 CLIP, fuse; 10M343 LEAD, elect.; 1 cond; No. 18 ga; str; ORG; 5" req'd; 1V80705A09 FUSE CLIP AND LEAD ASS'; incl 42A82884A01 CLIP, fuse 10M343 LEAD, elect.; 1 cond; No. 18 ga; str; ORG; 9" req'd ref part F402
XF403	1V80705A10	incl 14A82882A01 BODY, fuseholder; 14A82883A01 CAP, fuseholder; 41A82885A01 SPRING, fuseholder; 1V80705A11 FUSE CLIP AND LEAD ASS'; incl 42A82884A01 CLIP, fuse; 10M345 LEAD, elect.; 1 cond; No. 18 ga; str; GRN; 9" req'd; 1V80705A12 FUSE CLIP AND LEAD ASS'; incl 42A82884A01 CLIP, fuse 10M345 LEAD, elect.; 1 cond; No. 18 ga; str; GRN; 9" req'd ref part F403

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
NON-REFERENCED ITEMS		
	29A82602D01	CONNECTOR, plug: male; single cont; 19 req'd; SLEEVE, coded:
	37B82603D01	1
	37B82603D02	2
	37B82603D03	3
	37B82603D04	4
	37B82603D05	5
	37B82603D06	6
	37B82603D07	7
	37B82603D08	8
	37B82603D09	9
	37B82603D10	10
	37B82603D11	11
	37B82603D12	12
	37B82603D13	13
	37B82603D14	14
	37B82603D15	15
	37B82603D16	16
	37B82603D17	17
	37B82603D18	18
	37B82603D21	21

CONTROL HEAD

TGN6026AJ Control Head, Trunk Mount (Std. Squelch)
TGN6026AK Control Head, Trunk Mount (Dual Squelch) EPD-14829-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
DS501, 502	65R4151	LAMP, incandescent: 0.2 amp.; type #51
J501	9K830418	CONNECTOR, receptacle: female; 4 contact
		RESISTOR, fixed: ±10%; unl. stated
R501, 502	17C82350A04	33; 2 w
R503	18K857840	var. 25K ±30%
R504	6R5581	3.3K; 1/2 w
R505	6R6320	10K; 1/2 w
R506	18K868896	var.; 25K ±30%. 0.33 w; incl. S501 (TGN6026AJ)
	or18K857698	var.; 25K ±30%; 0.16 w (TGN6026AK)
R507	6R6336	270; 1 w
S501		SWITCH, rotary: unl. stated dpst; p/o R506 (TGN6026AK)
	or 40K80247	toggle; dpst (TGN6026AK)
S502	40C83624D01	1 pole; 4 pos.
S503	40A80246	toggle; dpdt
TB501	31C857699	BOARD, terminal: 35 female contacts
XDS501, 502	9B86316B	LAMPHOLDER: single contact; bayonet base
NON-REFERENCED ITEMS		
	61A865158	LENS, red
	61K865159	LENS, grn
	2A48070	NUT, knurled: 13/64"-27 x 1/8"
	3A82670A01	SCREW, machine; #6-32 x 1.44" (2 req'd)
	36K858652	KNOB, vol. control (2 req'd)
	36B82869D02	KNOB, freq. selector

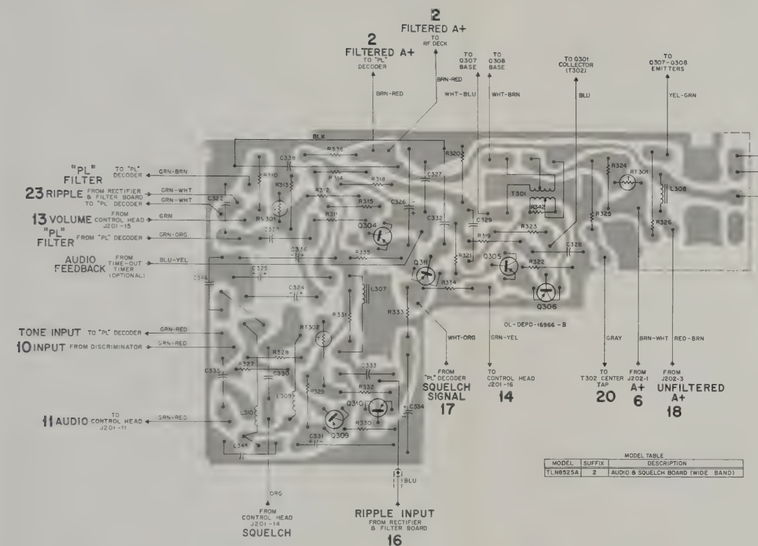
MICROPHONE

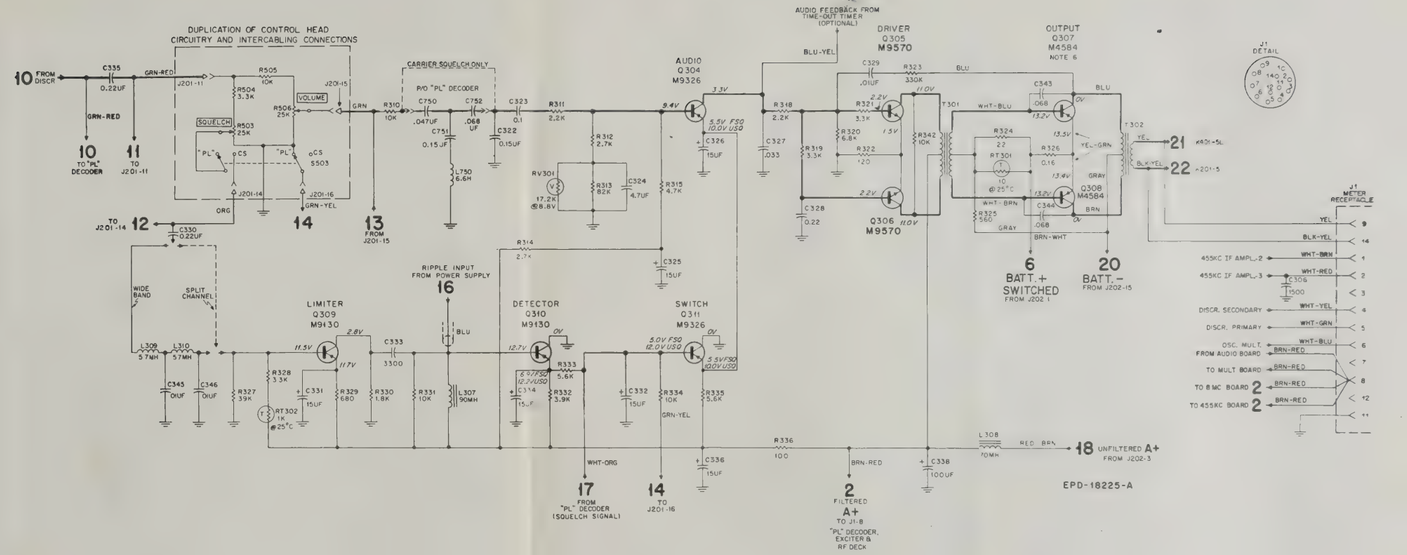
TMN6013A Microphone
TMN6018A Microphone Weatherproof EPD-9098-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
DP601	59D82933C01	CARTRIDGE, microphone: transistor amplifier
P601	28A16370	CONNECTOR, plug: male, 4 contact
S601	40C82263G02 (TMN6013A) or40C82263G01 (TMN6018A)	SWITCH, push: dpst (not replaceable in TMN6018A)
W601	1V80707A58 (TMN6013A)	CORD, microphone assembly, incl. P601 and the following items: 41A85270 SPRING, strain relief 29A847034 LUG, insulation-piercing; 4 req'd.
	or1V80724A28 (TMN6018A)	CORD, PLUG & SWITCH ASSY, incl. P601, S601
NON-REFERENCED ITEMS		
	1V80720A94	CASE, microphone, incl. hang-up stud (TMN6013A & TMN6018A)
	11M2506	TUBING; No. 9 BLK, 5" length req'd.
	3S124693	LOCKSCREW: 6-32 x 1/4" Phillips round head; 2 req'd.
	42A852710	STRAP; strain relief
	38A852699	PUSHBUTTON
	15D82701B01	COVER, microphone case (front) (TMN6013A & TMN6018A)
	32A82703B01	GASKET; neoprene
	4S114201	WASHER; 1/4" x 0.156" x .015 3 req'd.
	3S127924	LOCKSCREW; 6-32 x 5/16" Phillips round head
	3S132436	SCREW, machine; 6-32 x 13/16" Phillips round head 3 req'd.
	42B82702B01	RETAINER, mic, cartridge
	1V86539B	MOUNTING KIT, microphone incl. 54A85596 PLATE mic. hang-up; 3S122830 SCREW, tapping; No. 8 x 1/2" slotted binder head; 2 req'd.

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.


2 FILTERED A+
2 FILTERED A+ TO RF DECK
TO "PL" DECODER
TO Q307 BASE
TO Q308 BASE
TO Q301 COLLECTOR (T302)
TO Q307-Q308 EMITTERS
"PL" FILTER TO "PL" DECODER
23 RIPPLE FROM RECTIFIER & FILTER BOARD
13 VOLUME FROM CONTROL HEAD J201-15
"PL" FILTER FROM "PL" DECODER
AUDIO FEEDBACK FROM TIME-OUT TIMER (OPTIONAL)
TONE INPUT TO "PL" DECODER
10 INPUT FROM DISCRIMINATOR
11 AUDIO TO CONTROL HEAD J201-11
BRN-GRN TO PWR SUP 3
BRN-GRN TO RCVR MULT BD 3 +8.8V
BRN-RED TO J1-8 FILTERED A+2
FROM "PL" DECODER SQUELCH SIGNAL 17
TO CONTROL HEAD J201-16 14
TO T302 CENTER TAP 20
FROM J202-1 A+ 6
FROM J202-3 UNFILTERED A+ 18
OL-DEPD-16966-B
MODEL TABLE
MODEL | SUFFIX | DESCRIPTION
TLN8525A | 2 | AUDIO & SQUELCH BOARD (WIDE BAND)
FROM CONTROL HEAD J201-16 SQUELCH
RIPPLE INPUT FROM RECTIFIER & FILTER BOARD 16



FOR MODELS TLN8525A-1 OR LATER, REFER TO CIRCUIT BOARD DETAIL EPD-17455.

EPD-17494-A

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Model TLN8525A-2 Audio and Squelch Circuit Board Detail used in "Private-Line" 406-420 & 450-470 MC "Motrac" Radio Sets
Motorola No. PEPD-16965-D (SMR-116E)
5/29/68-UP

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TLN8513A-1 TLN8525A-1		PRINTED CIRCUIT BOARD REVISED	REFER TO EPD-17455-O
B	TLN8513A-1 TLN8525A-1		REMOVED EX-TRANEOUS PORTION OF SCHEMATIC DIAGRAM	PARTIAL SCHEMATIC
C	TLN8513A-1		REMOVED	MODEL TABLE
D	TLN8525A-2	Q305, Q306	WERE 48K869357, M9357	PARTS LIST

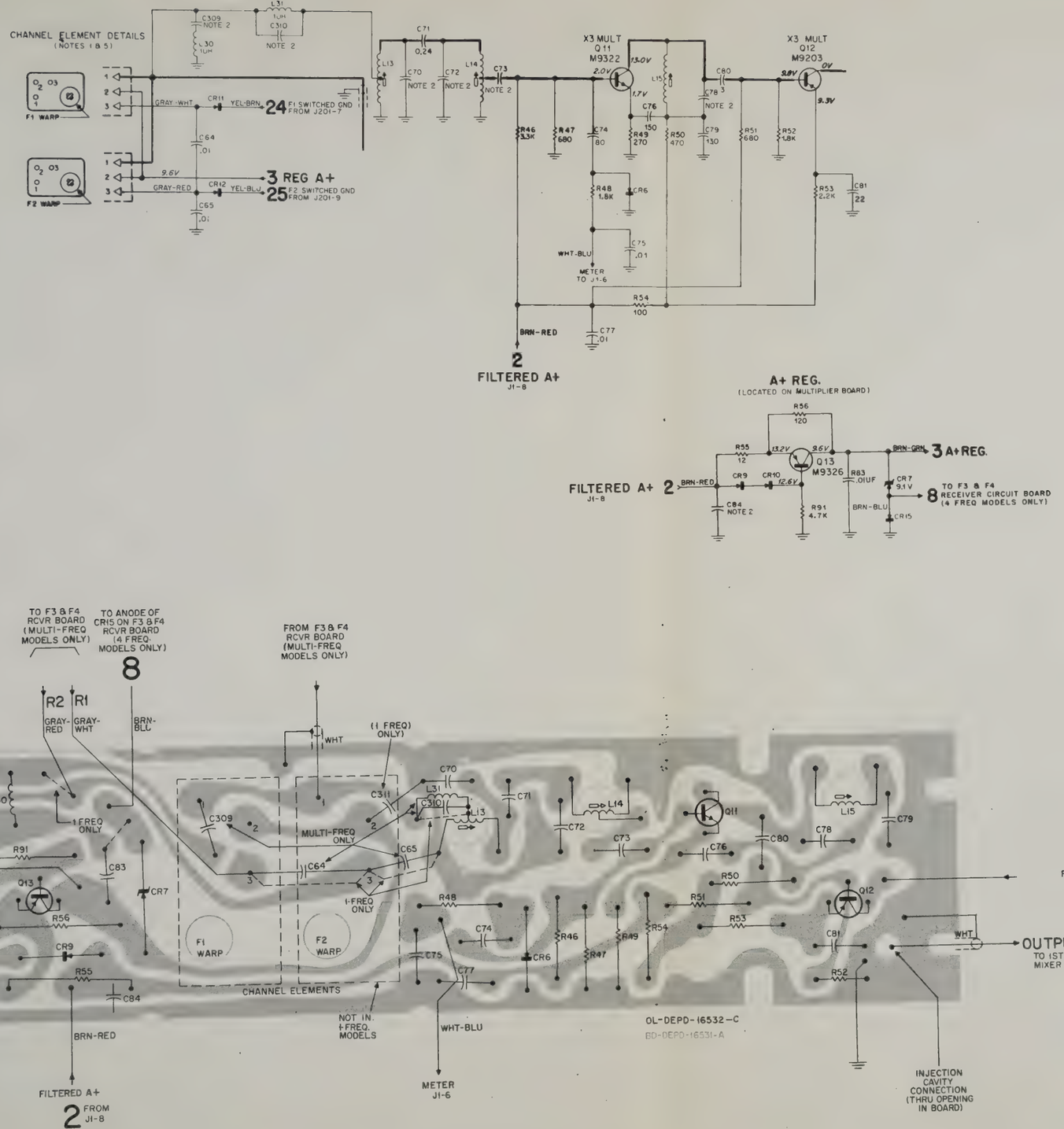
PARTS LIST

TLN8525A Audio & Squelch (Wideband) EPD-18228-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf ±10%; 50 v; unl stated
C322	8D82905G05	0.15
C323	8D82905G07	0.10; 500 v
C324	23K865137	4.7; 25 v
C325, 326, 331, 332, 334, 336	23K865136	15; 25 v
C327	8D82905G16	.033; 100 v
C328, 335	8D82905G11	0.22
C329	8D82905G01	.01
C330	8D82905G12	0.22
C333	8D82905G25	.0033; 100 v
C338	23D82601A25	100 +150-10%; 20 v
C345, 346	8D82905G14	.01; 100 v
		COIL, audio: choke;
L307	25B82738C01	90 mh
L308	25B82878A03	70 mh
L309, 310	24C82835G16	5.7 mh
		TRANSISTOR: (SEE NOTE)
Q304, 311	48R869326	P-N-P; type M9326
Q305, 306	48R869570	N-P-N; type M9570
Q309, 310	48R869130	P-N-P; type M9130
		RESISTOR: fixed; ±10%; 1/4 w; unl stated
R310	6S129668	10K ±5%
R311, 318	6S129804	2.2K ±5%
R312, 314	6S128688	2.7K
R313	6S129145	82K
R315	6S127804	4.7K
R319, 321, 328	6S129981	3.3K ±5%
R320	6S129237	6.8K ±5%
R322	6S129617	120
R323	6S129473	330K ±5%
R324	6S131641	22
R325	6S6291	560; 1/2 w
R326	17C82350A05	0.16; 1 w
R327	6S128903	39K
R329	6S128599	680
R330	6S129269	1.8K
R331, 334, 342	6S129225	10K
R332	6S129232	3.9K
R333, 335	6S129433	5.6K
R336	6S129753	100
		THERMISTOR:
RT301	6C82769A01	10 ohms
RT302	6B858402	1K ohms
		VARISTOR:
RV301	6B858401	17.2K; 8.8 v
		TRANSFORMER: audio driver
T301	25C82058H01	pri. term. No. 1: term. No. 3 w/center tap @ term. No. 2 total coil res 670 ohms sec. term. No. 4 term. No. 6 w/center tap @ term. No. 5; total coil res 13 ohms

NOTE:

Replacement transistors must be ordered by Motorola part number only for optimum performance.



MODEL	SUFFIX
TLN8311A	
TLN8313A	2
TLN8541A	2

FOR UNITS WITHOUT A SUFFIX, REFER TO CIRCUIT BOARD DIAGRAM EPD-13785.

EPD-16602-B

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

1st Oscillator & Multiplier Circuit Board Detail
Models TLN8311A, TLN8313A and TLN8541A
406-420 & 450-470 MC "Motrac" Receivers
Motorola No. EPD-16533-C (T-2502C)
3/6/67-UP

REVISIONS

DIAG ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TLN8313A-2 TLN8541A-2	C309, 310, 311	ADDED	CENTER OF CIRCUIT BD.
		L31	ADDED	
		L30	ADDED	TOP LEFT OF CIRCUIT BD.
B	TLN8541A-2	L13	WAS 24V80905A64 (ADDED REF. PARTS C310 & L31)	TOP CENTER OF CIRCUIT BOARD
C	TLN8311A		ADDED	PARTS LIST

PARTS LIST

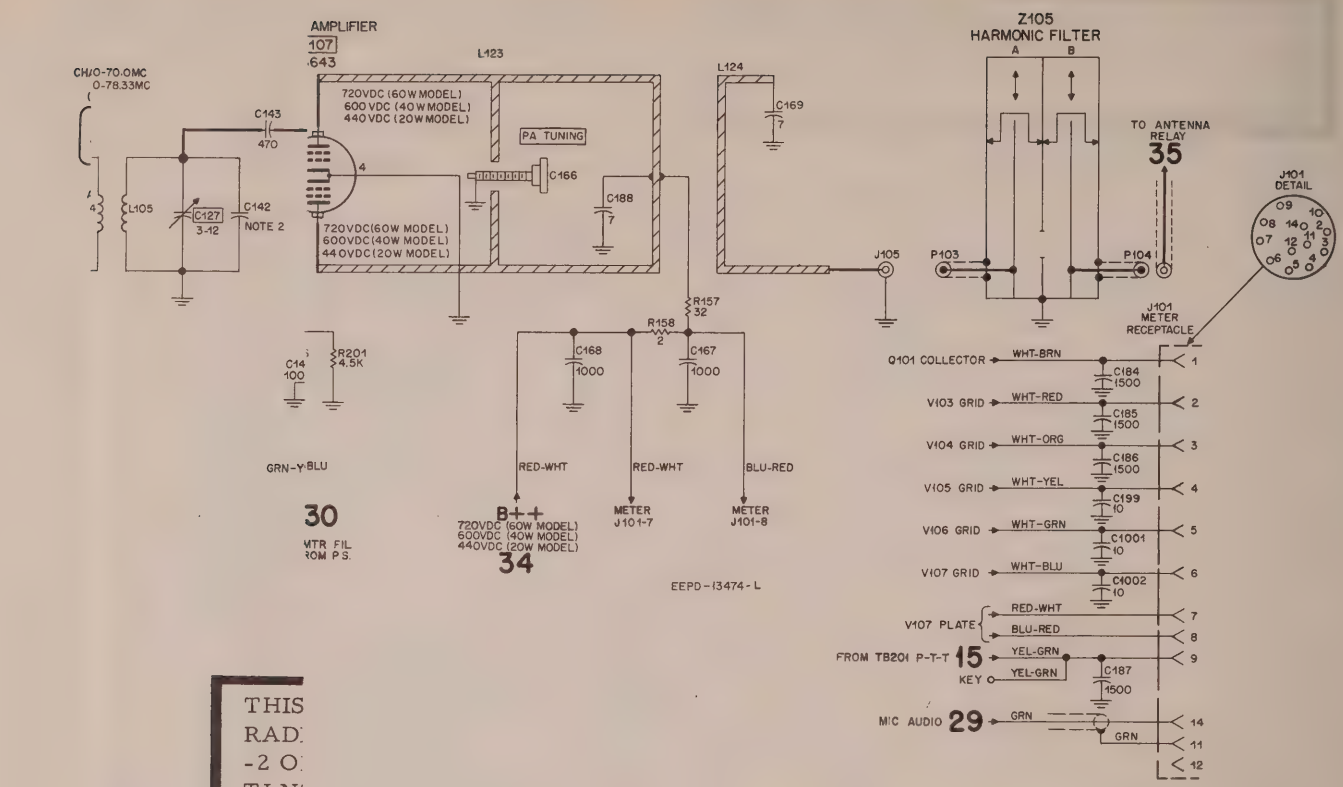
TLN8311A Oscillator Kit
(Multiple-Frequency Operation) 406-420 MC
TLN8313A Oscillator Kit
(Single-Frequency Operation) 450-470 MC
TLN8541A Oscillator Kit
(Multiple-Frequency Operation) 450-470 MC

EPD-14203-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf; ±5%; 500 v; unl stated
C64, 65, 75, 77, 83	21C82428B59	.01 uf +80-20%; 200 v
C70, 72	21K840845	24; N220 (TLN8313A, TLN8541A)
	or21K849335	30; N150 (TLN8311A)
C71	21D82450B05	0.24 ±10%; NP0
C73	21D82610C03	47; 200 v; N220 (TLN8313A & TLN8541A only)
	or21D82610C47	57; 100 v; N220 (TLN8311A only)
C74	21D82133G09	80; N750
C76	21D863147	150 ±10%; 400 v
C78	21D82133G11	4 ±0.5 uuf; NP0 (TLN8313A, TLN8541A)
	or21K849333	6 .25 uuf; N330 (TLN8311A)
C79	21D82610C28	130; 200 v; N470
C80	21K868935	3 ±0.25 uuf; 2000 v; N750
C81	21D82133G20	22 ±5%; N330
C84	21D82187B29	1000 ±10%; 100 v (TLN8311A only)
C309	21K831125	100 ±10%; 300 v (TLN8313A & TLN8541A only)
	or21D82610C27	120; 200 v; N470 (TLN8311A only)
C310	21K861436	100 ±10%; 75 v (TLN8313A & TLN8541A only)
	or21D82877B41	120 ±10%; 75 v; N750 (TLN8311A only)
C311	21K832501	.01 uf +60-40%; 250 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR6	48C82921G02	germanium
CR7	48D82256C43	silicon; zener type (single-frequency)
	or48D82256C56	silicon; zener type (multi-frequency)
CR9, 10	48C82392B05	silicon
		COIL, RF:
L13	24V80906A29	incl. ref. parts C310, L31 and 76B82098H01 CORE, tuning
L14	24V80905A64	incl. 24B83868D01 COIL, tapped 76B82098H01 CORE, tuning
L15	24V80905A19	incl. 24B83670C01 COIL, 4-3/4 turns; 76B82098H01 CORE, tuning
L30, 31	24B864019	choke; 1 uh
		TRANSISTOR: (SEE NOTE)
Q11	48R869322	N-P-N; type M9322
Q12	48R869203	P-N-P; type M9203
Q13	48R869326	P-N-P; type M9326
		RESISTOR, fixed: ±10%; 1/4 w unl stated
R46	6S129231	3.3K
R47, 51	6S128599	680
R48, 52	6S129269	1.8K
R49	6S129752	270
R50	6S127801	470
R53	6S128689	2.2K
R54	6S129753	100
R55	6S114262	12 ±5%; 1/2 w
R56	6S5551	120; 1/2 w
R91	6S6080	4.7K; 1/2 w
	NON-REFERENCED ITEM	
	26A82076C01	SHIELD, coil (used with L13, L14, L15)

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.



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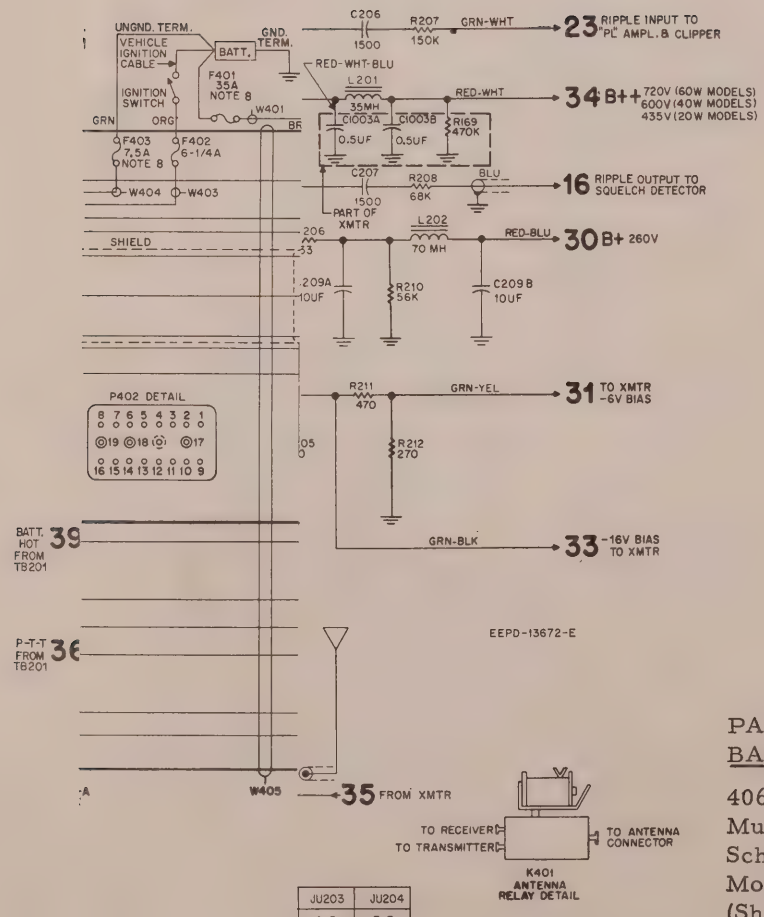


JU203	JU204
A-B	E-F
B-C	E-F
A-B	D-E

S HAVE RED-BRN AND
NNECTIONS REVERSED

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

406-420 & 450-470 MC
Multi-Frequency Operation "Motrac" Radio Set
Schematic and Intercabling Diagram
Motorola No. 63P81048A88-M (MR-2255B)
(Sheet 2 of 2)
3/28/68-UP

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A			NOTES REVISED	

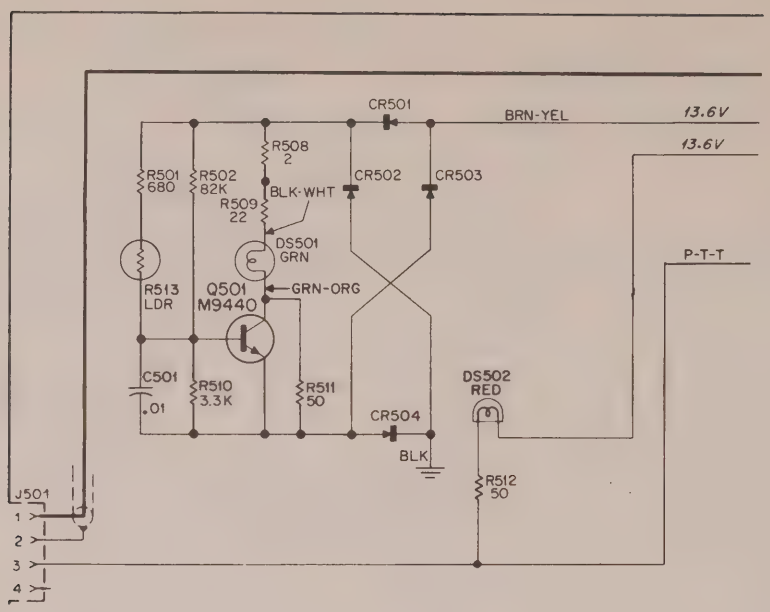
PARTS LIST

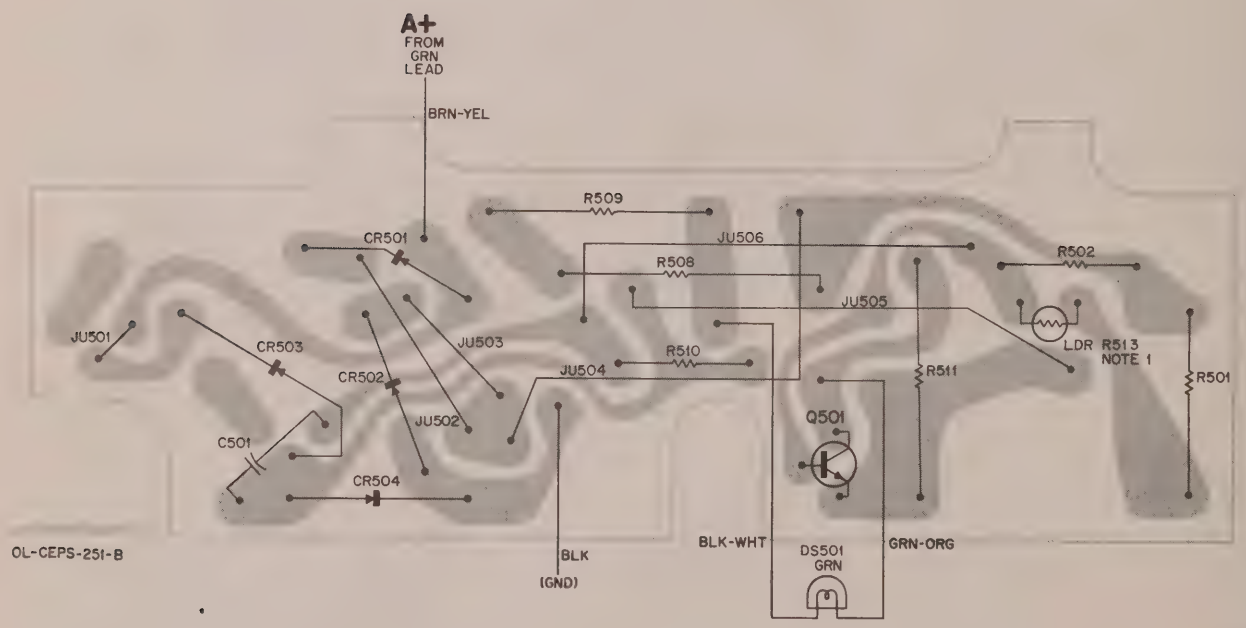
1V80700B07 Light Dimmer Board PL-151-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C501	21D82428B62	CAPACITOR, fixed: .01 uf +80-20%; 200 v
CR501 thru 504	48C82466H01	SEMICONDUCTOR DEVICE, diode: SEE NOTE
Q501	48R869440	TRANSISTOR, N-P-N: type M9440
		RESISTOR, fixed:
R501	6S6040	680 ±10%; 1/2 w
R502	6S129145	82K ±10%; 1/4 w
R508	17C82036G03	2 ±5%; 3 w
R509	17D83122D09	22 ±5%; 3 w
R510	6S129231	3.3K ±10%; 1/4 w
R511	17C82291B15	50 ±5%; 3 w
R513	6C83828D01	light dependent type; 6.4K-10K @ 25°C
NON-REFERENCED ITEM		
	1V80765A48	CIRCUIT BOARD ASSY. (less components)

NOTE:

Replacement diodes must be ordered by Motorola part number only for optimum performance.





NOTES:
1. R513 IS LOCATED BEHIND LIGHT WINDOW.
2. JU501, 2, 3, 4, 5, 6, USED TO COMPLETE CIRCUIT CONTINUITY ONLY.

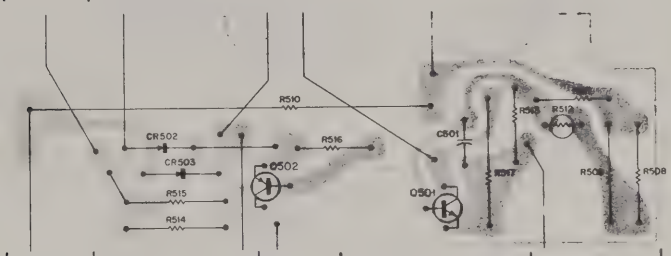
E = EMITTER
B = BASE
C = COLLECTOR

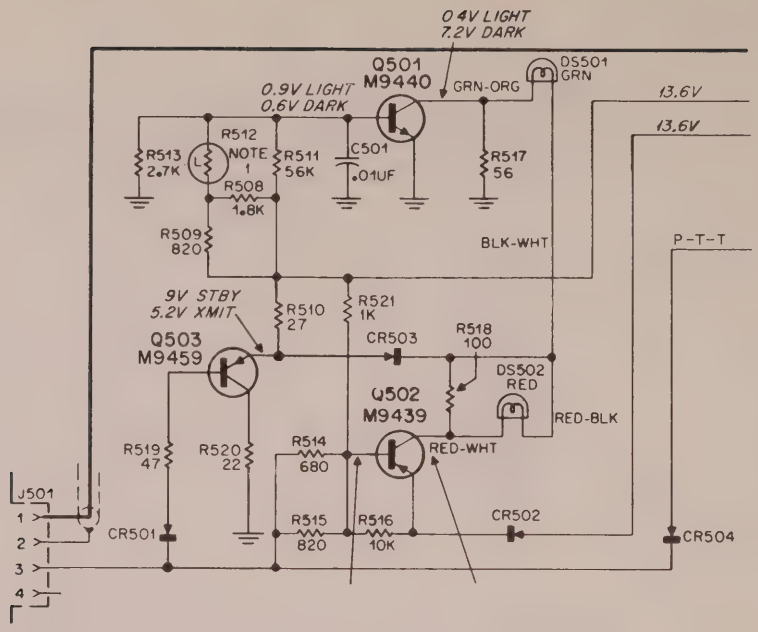
PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

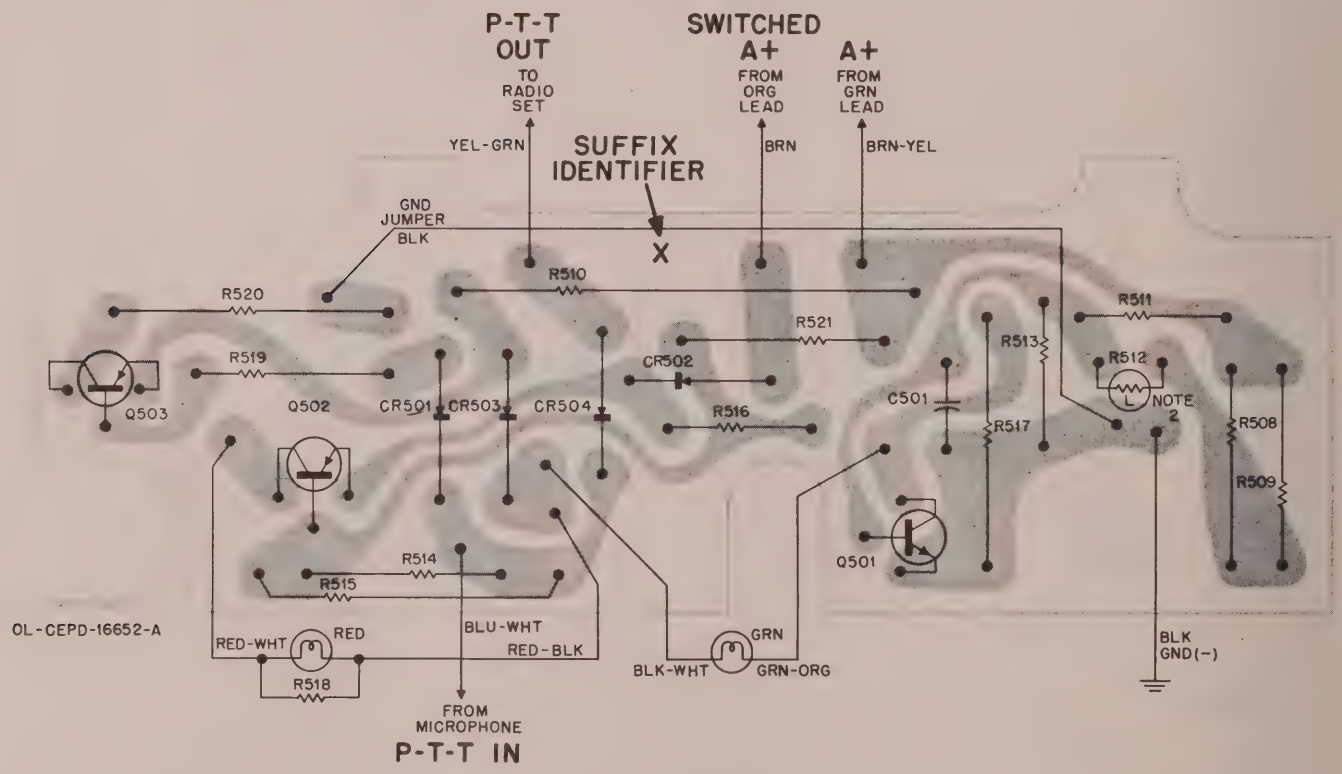
Pilot Light Dimmer Circuit Board Detail
Used in "Motrac" & "Motran" Radio Sets
Motorola No. PEPS-250-A1 (SMR-201A)
9/6/68-UP

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TCN6098AK TCN6099AE TCN6099AF TCN6100AE TCN6100AF TCN6099AG TCN6099AH TCN6100AG TCN6100AH TCN6100AJ TCN6100AK TCN6097AE TCN6097AF TCN6098AE TCN6098AF TCN6097AG TCN6097AH TCN6098AG TCN6098AH TCN6098AJ		REVISED CIRCUIT BOARD PLATING. BOARD WAS AS SHOWN BELOW.	
B			ADDED VOLTAGES	







NOTES:

1. SEE PARTS LIST (ON SCHEMATIC DIAGRAM) FOR COMPONENT VALUES.
2. R512 IS LOCATED BEHIND LIGHT WINDOW.

PREVIOUS REVISIONS SHOWN ON BACK OF THIS DIAGRAM

Pilot Light Dimmer Circuit Board Detail
Used in "Motrac" & "Motran" Radio Sets
Motorola No. EPD-14975-B (T-2494A)
1/23/67-UP

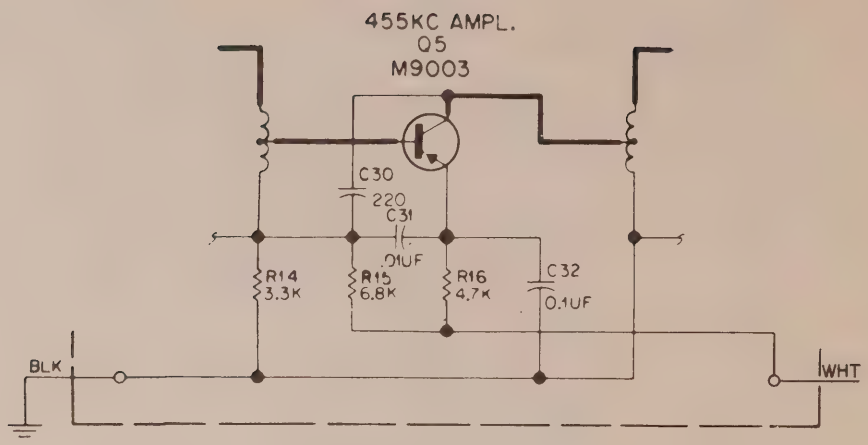
PARTS LIST

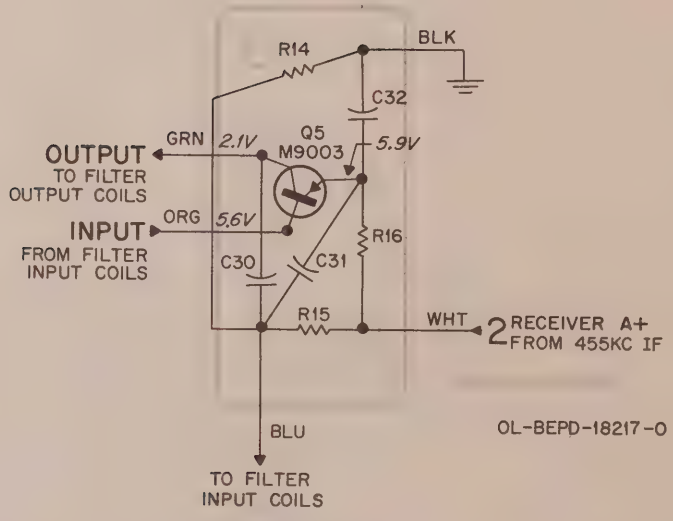
1V80738A21 455 KC Filter Amplifier Board EPD-18226-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C30	21D82428B20	220 uuf ±20%; 100 v
C31	21D82428B19	.01 uf ±20%; 100 v
C32	21C82372C01	0.1 uf +80-20%; 25 v
		TRANSISTOR: (SEE NOTE)
Q5	48R869003	P-N-P; type M9003
		RESISTOR, fixed: ±10%; 1/4 w unl stated
R14	6K129231	3.3K
R15	6K128687	6.8K
R16	6K127804	4.7K
NON-REFERENCED ITEM		
	1V80721A78	CIRCUIT BOARD ASSEMBLY (eyeleted)

NOTE:

Replacement transistors must be ordered by Motorola part number only for optimum performance.





IMPORTANT

A+ FILTER COMPONENTS ARE NOT SHOWN ON PARTIAL SCHEMATIC. REFER TO A+ DISTRIBUTION DETAIL ON THE RADIO SET SCHEMATIC DIAGRAM.

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

455 KC Filter Amplifier Circuit Board Detail
P/O Model TFN6017AW (Wideband) IF Filter
Used in "Motrac" Receivers
Motorola No. PEPD-18218-O (T-2502J)
3/6/67-UP

INSTRUCTION MANUAL REVISION SMR-264

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL(S) AFFECTED:

406-420 MC and 450-470 MC "Motrac" FM Radios

REVISION DETAILS

With this change the following becomes effective:

Instruction Manual No.	Schem. Diag. & New Issue	Pwr. Supply & New Suffix	Ckt. Bd. Detail	New Issue
68P81038A90	63P81048A87-M	TPN1048AA-1	EPD-13878	B
68P81043A65	63P81048A88-P	TPN1048AC-1		

Component Change

Ref. Sym.	Action	Part No.	Description
TB201	Removed	1V80761A89	BOARD, terminal: assy; 10 lug riveted

MOTOROLA

INSTRUCTION MANUAL REVISION SMR-220

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL(S) AFFECTED:

450-470 MC "Motrac", "Mocom · 30" and Consolette Base Station

REVISION DETAILS

With this change the following becomes effective:

Instruction Manual No.	Tone Generator & New Suffix*	Ckt. Bd. Detail	New Issue
68P81038A90	TLN8271A	EPD-13724	B
68P81043A65			
68P81038A40-B			
68P81054A55-O		PEPD-19840	A
68P81051A15-O		PEPD-18621	A

*Suffix Remains Unchanged.

Component Changes

Ref. Sym.	Action	Part No.	Description
C706	Changed to	8D82904G05	CAPACITOR, fixed: 0.15 uF ±10%; 50 v
R706	Changed to	6S129887	RESISTOR, fixed: 12K ±5%; 1/4 w
R718	Changed to	6S129230	RESISTOR, fixed: 12K ±10%; 1/4 w

Instruction Manual No.	Schem. Diag. & New Issue	Audio Bd. & New Suffix	Ckt. Bd. Detail	New Issue	Change Item No.
68P81055A15-O	63E81055A16-A, 63E81056A57-B	TLN8546B-2	PEPD-20537	A	1
68P81048A30-O, 68P81048A30-A	63E81048A31-D	XLN6370A-1	PEPD-17210	B	1
68P81050A70-O	63E81050A71-F		EPD-18109	A	1
68P81053A70-O	63E81053A71-B		EPD-20195	A	1
68P81049A95-O	63E81049A96-D	XLN6387A-1	EPD-18385	B	1

Component Change

Change Item No.	Ref. Sym.	Action		
1	Q305, 306	Changed to	48R869570	TRANSISTOR, N-P-N: type M9570
2	Q19, 20	Changed to		Same as change item 1

MOTOROLA

INSTRUCTION MANUAL REVISION SMR-116

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL(S) AFFECTED:

136-174MC, 406-420MC and 450-470MC "Motrac" and "Motran" FM Radio

REVISION DETAILS

With this change the following becomes effective:

Instruction Manual No.	Schem. Diag. & New Issue	Audio Bd. & New Suffix	Ckt. Bd. Detail	New Issue	Change Item No.
68P81040A45	63P81040A46-AS	TLN8399A-4,	EPD-16454	B	1
68P81044A10	63P81044A11-AM	TLN8546A-1			
68P81049A95-O	63E81049A97-B				
68P81043A75	63P81043A76-P	TLN8513A-2	PEPD-17471	A	1
68P81041A20	63P81041A21-S				
68P81033A15	63P81033A16-T				
68P81038A80	63P81038A81-S				
68P81054A30	63P81054A31-A				
68P81041A25	63P81041A26-U		PEPD-17457	A	1
68P81043A80	63P81043A81-R				
68P81043A25	63P81043A26-U				
68P81046A10	63P81046A11-V				
68P81054A25	63P81054A26-B				
68P81054A35	63P81054A36-A				
68P81051A45	63P81051A46-C		PEPD-19367	A	1
68P81051A50	63P81051A51-C		PEPD-19371	A	1
68P81051A55	63P81051A56-C				
68P81048A10-O	63E81048A11-F		PEPD-15853	B	1
68P81048A35-O	63E81048A36-E		PEPD-15851	B	1
68P81051A10-O	63P81051A11-E		PEPD-19068	C	1
68P81057A50-O	63E81057A51-A		PEPD-19068	C	1
68P81038A90	63P81048A87-L	TLN8525A-2	PEPD-16965	D	1
68P81043A65	63P81048A88-N		PEPD-17455	C	1
68P81047A60-O	63E81047A63-J		EPD-16559	A	2
68P81051A15-O	63E81053A64-F		PEPD-18619	B	1

Instruction Manual No.	455 KC Board	New Suffix*	Ckt. Bd. Detail	New Issue	Change Item No.
68P81026A10					
68P81026A20					
68P81043A05					
68P81043A10					
68P81043A15					
68P81043A20					
68P81054A05					
68P81054A15					
68P81033A15					
68P81038A80					
68P81041A25					
68P81043A25					
68P81043A80					
68P81046A10					
68P81051A45					
68P81051A50					
68P81051A55					
68P81054A25					
68P81054A30					
68P81054A35					
68P81026A15					

*Suffix Remains Unchanged

Component Change

Change Item No.	Ref. Sym.	Action	Part No.	Description
1	C60	Changed to	21D82133G82	CAPACITOR; fixed; 80 uuf ±10%; 500 V; N1500
2	C59	Changed to		same as change item 1
3	C67	Changed to		same as change item 1

Instruction Manual No.	455 K Board	New Suffix*	Ckt. Bd. Detail	New Issue	Change Item No.
68P81033A90-A			EPD-10659	D	3
68P81042A25-O			PEPD-16198	C	3
68P81038A95			EPD-13358	F	3
68P81039A75					
68P81042A05					
68P81053A95					
68P81054A10					
68P81041A20					
68P81043A75					
68P81054A20					
68P81048A35-O					
68P81038A35-A					
68P81044A65-B			EPD-11065	H	3
68P81044A70-A					
68P81044A75-A					
68P81044A80-A					
68P81044A85-A					
68P81044A90-A					
68P81045A05-O					
68P81055A15-O					
68P81040A45					
68P81044A10					
68P81051A25-O					
68P81051A30-O					
68P81051A35-O					
68P81051A40-O					
68P81049A95-O					
68P81030A45			EPD-13211	G	3
68P81030A50					
68P81030A55					
68P81030A60					
68P81039A05					
68P81039A10					
68P81039A15					
68P81039A80					
68P81039A85					
68P81039A90					
68P81042A10					
68P81042A15					
68P81042A20					
68P81042A80					
68P81042A85					
68P81042A90					
68P81042A95					
68P81045A10-O					

MOTOROLA

INSTRUCTION MANUAL REVISION SMR-105

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL (S) AFFECTED:

25-50 MC and 136-174 MC "Motrac" and "Motran" FM Radios
25-50 MC and 136-174 MC Base Station FM Radios
156-163 MC Maritime FM Radio
136-174 MC "Mocom · 30" FM Radio

REVISION DETAILS

With this change the following becomes effective:

Instruction Manual No.	Schematic Diagram No.	New Issue	455 KC Bd.	New Suffix*	Change Item No.
68P81025A80-C	63E81025A81	W2	TLN6723B	2	1
	63E81025A82	P1	TLN6654B	2	1
68P81049A90-O	63E81049A91	A1			1
68P81045A80-O	63E81045A81	O1			1

Instruction Manual No.	455 KC Board	New Suffix*	Ckt. Bd. Detail	New Issue	Change Item No.
68P81054A75-A	TLN8308A,	2	EPD-13858	E	2
68P81038A90	TLN8578A	3			
68P81043A65					
68P81054A50-O	TLN8665A		PEPD-19388	A	1
68P81050A70-O	XLN6377A		EPD-18104	A	3
68P81043A55-A	TLN6733BS	4	EPD-13531	H	3
68P81046A40-B	TLN6733BW	3			
68P81047A55-A			EPD-11973	F	3
68P81040A35-A					
68P81045A35-A					
68P81045A20-A					
68P81045A25-B					
68P81045A45-D					
68P81045A30-B					
68P81045A40-C					
68P81026A05			EPD-10359	G	3
68P81037A65-A					

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Radio Set with TLN8626A or TLN8525A Audio Board Schematic & Intercabling Diagram and Parts List 63P81048A88
Control Head with Dimmer Schematic Diagram and Parts List (TCN6098AK) 63D81043A42
Control Head with Dimmer Schematic Diagram and Parts List (TLN6098BK) 63D81000E02
Transmitter Alignment Procedure EPD-13475
"IDC" Adjustment Procedure EPD-6633
Receiver Alignment Procedure EPD-13869
Circuit Board Location Diagram EPD-13876
Control Head with Dimmer Circuit Board Detail (TCN6098AK) EPD-14975
Control Head with Dimmer Circuit Board Detail (TCN6098BK) PEPS-250
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1st Oscillator & Multiplier Circuit Board Detail and Parts List EPD-16533
F3 & F4 Receiver Circuit Board Detail and Parts List EPD-15616
8 MC IF & 2nd Oscillator Circuit Board Detail and Parts List EPD-13788
455 KC IF Amplifier Circuit Board Detail and Parts List EPD-13858
455 KC Filter Amplifier Circuit Board Detail and Parts List PEPD-18218
TLN8268A Audio and Squelch Circuit Board Detail and Parts List EPD-13872
TLN8525A Audio and Squelch Circuit Board Detail and Parts List PEPD-16965
TLN8626A Audio and Squelch Circuit Board Detail and Parts List PEPD-18176
Audio and Squelch Circuit Board Detail and Parts List PEPD-17455
Transmitter Channel Element Circuit Board Detail and Parts List EPD-15381
Exciter Circuit Board Detail and Parts List EPD-13718
"IDC" Circuit Board Detail and Parts List EPD-13721
"Private-Line" Tone Generator Circuit Board Detail and Parts List EPD-13724
"Private-Line" Decoder and Filter Circuit Board Detail and Parts List EPD-13875
Power Supply Rectifier and Filter Circuit Board Detail and Parts List EPD-13878
Ground Reversing Kit Circuit Board Detail and Parts List EPD-14830
TLN1108A Time-Out Timer Circuit Board Detail and Parts List EPD-15016
TLN1143A Time-Out Timer Circuit Board Detail and Parts List PEPD-17270
Instruction Manual 68P81040A05

PARTS LISTS FOR PRINTED CIRCUIT BOARDS ARE ON THE BACK OF THE CORRESPONDING PRINTED CIRCUIT BOARD DETAILS

p/o 68P81043A65

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TLN1143A Time-Out Timer Circuit Board Detail and Parts List PEPD-17270
Instruction Manual 68P81040A05

PARTS LISTS FOR PRINTED CIRCUIT BOARDS ARE ON THE BACK OF THE CORRESPONDING PRINTED CIRCUIT BOARD DETAILS

p/o 68P81043A65

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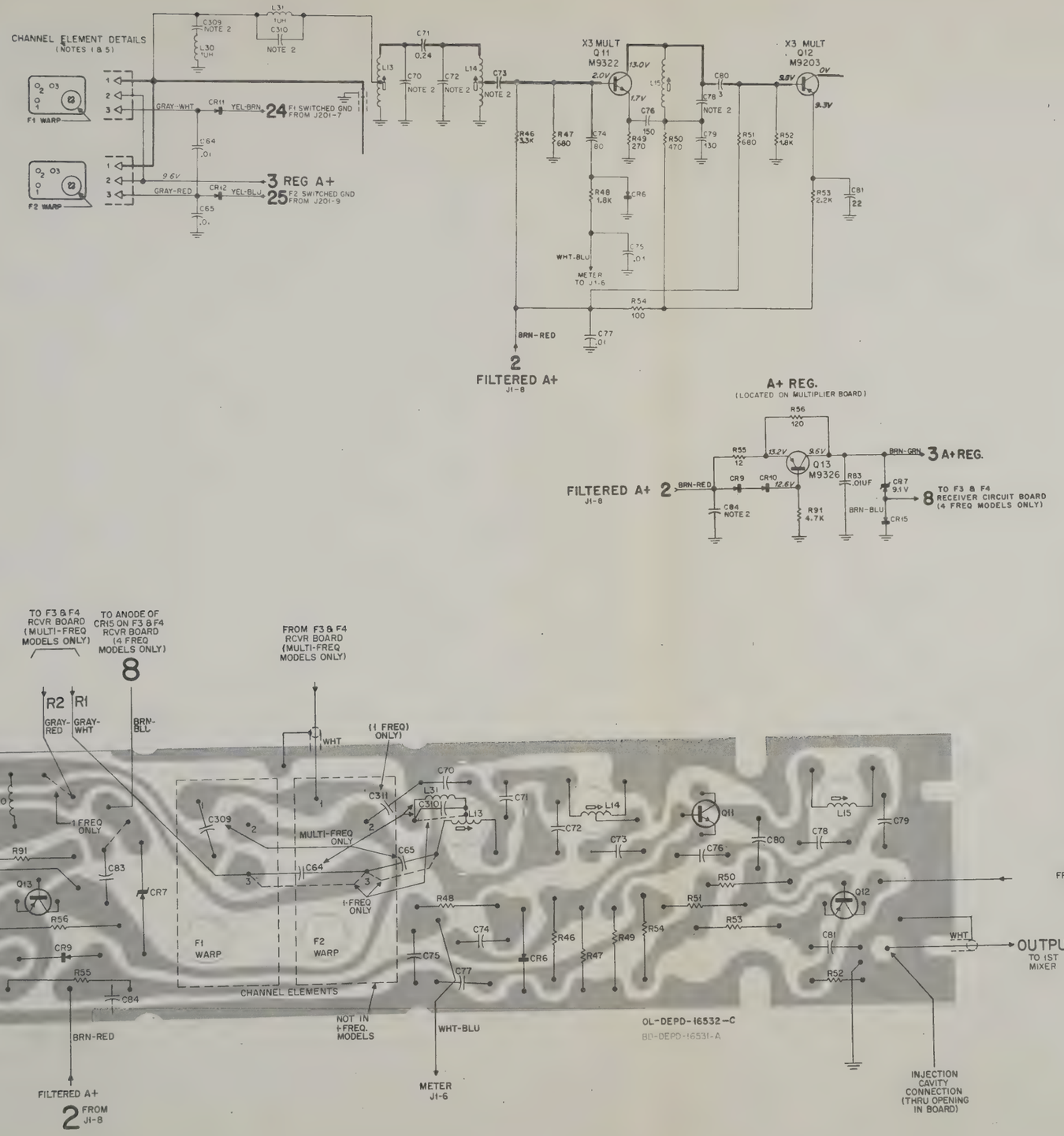


MODEL	SUFFIX
TLN8311A	
TLN8313A	2
TLN8541A	2

FOR UNITS WITHOUT A SUFFIX, REFER TO CIRCUIT BOARD DIAGRAM EPD-13785.

EPD-16602-B

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

1st Oscillator & Multiplier Circuit Board Detail
Models TLN8311A, TLN8313A and TLN8541A
406-420 & 450-470 MC "Motrac" Receivers
Motorola No. EPD-16533-C (T-2502C)
3/6/67-UP

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TLN8313A-2 TLN8541A-2	C309, 310, 311	ADDED	CENTER OF CIRCUIT BD.
		L31	ADDED	
		L30	ADDED	TOP LEFT OF CIRCUIT BD.
B	TLN8541A-2	L13	WAS 24V80905A64 (ADDED REF. PARTS C310 & L31)	TOP CENTER OF CIRCUIT BOARD
C	TLN8311A		ADDED	PARTS LIST

PARTS LIST

TLN8311A Oscillator Kit
(Multiple-Frequency Operation) 406-420 MC
TLN8313A Oscillator Kit
(Single-Frequency Operation) 450-470 MC
TLN8541A Oscillator Kit
(Multiple-Frequency Operation) 450-470 MC

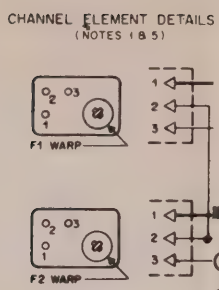
EPD-14203-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf; ±5%; 500 v; unl stated
C64, 65, 75, 77, 83	21C82428B59	.01 uf +80-20%; 200 v
C70, 72	21K840845	24; N220 (TLN8313A, TLN8541A)
	or21K849335	30; N150 (TLN8311A)
C71	21D82450B05	0.24 ±10%; NP0
C73	21D82610C03	47; 200 v; N220 (TLN8313A & TLN8541A only)
	or21D82610C47	57; 100 v; N220 (TLN8311A only)
C74	21D82133G09	80; N750
C76	21D863147	150 ±10%; 400 v
C78	21D82133G11	4 ±0.5 uuf; NP0 (TLN8313A, TLN8541A)
	or21K849333	6 .25 uuf; N330 (TLN8311A)
C79	21D82610C28	130; 200 v; N470
C80	21K868935	3 ±0.25 uuf; 2000 v; N750
C81	21D82133G20	22 ±5%; N330
C84	21D82187B29	1000 ±10%; 100 v (TLN8311A only)
C309	21K831125	100 ±10%; 300 v (TLN8313A & TLN8541A only)
	or21D82610C27	120; 200 v; N470 (TLN8311A only)
C310	21K861436	100 ±10%; 75 v (TLN8313A & TLN8541A only)
	or21D82877B41	120 ±10%; 75 v; N750 (TLN8311A only)
C311	21K832501	.01 uf +60-40%; 250 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR6	48C82921G02	germanium
CR7	48D82256C43	silicon; zener type (single-frequency)
	or48D82256C56	silicon; zener type (multi-frequency)
CR9, 10	48C82392B05	silicon
		COIL, RF:
L13	24V80906A29	incl. ref. parts C310, L31 and 76B82098H01 CORE, tuning
L14	24V80905A64	incl. 24B83868D01 COIL, tapped 76B82098H01 CORE, tuning
L15	24V80905A19	incl. 24B83670C01 COIL, 4-3/4 turns; 76B82098H01 CORE, tuning
L30, 31	24B864019	choke; 1 uh
		TRANSISTOR: (SEE NOTE)
Q11	48R869322	N-P-N; type M9322
Q12	48R869203	P-N-P; type M9203
Q13	48R869326	P-N-P; type M9326
		RESISTOR, fixed: ±10%; 1/4 w unl stated
R46	6S129231	3.3K
R47, 51	6S128599	680
R48, 52	6S129269	1.8K
R49	6S129752	270
R50	6S127801	470
R53	6S128689	2.2K
R54	6S129753	100
R55	6S114262	12 ±5%; 1/2 w
R56	6S5551	120; 1/2 w
R91	6S6080	4.7K; 1/2 w
		NON-REFERENCED ITEM
	26A82076C01	SHIELD, coil (used with L13, L14, L15)

NOTE:

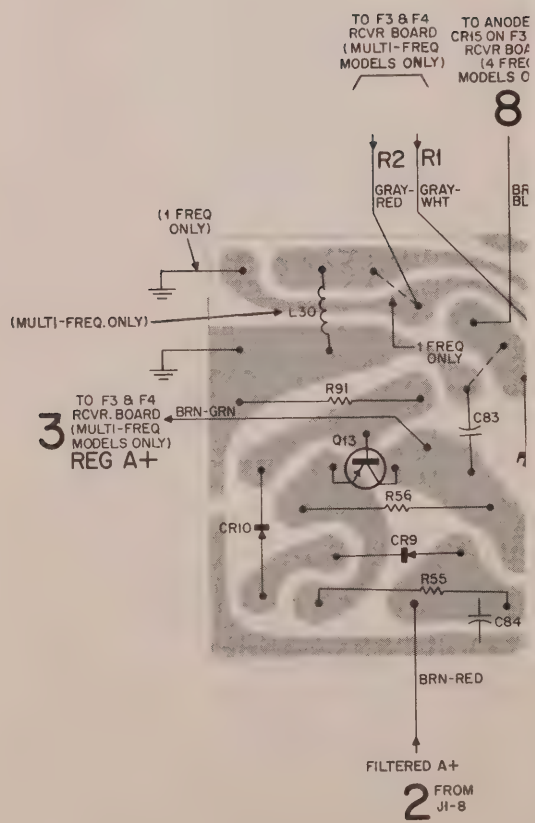
Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

MODEL	SUFFIX
TLN8311A	
TLN8313A	2
TLN8541A	2



FOR UNITS WITHOUT A SUFFIX, REFER TO CIRCUIT BOARD DIAGRAM EPD-13785.

EPD-16602-B



PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

1st Oscillator & Multiplier Circuit Board Detail
Models TLN8311A, TLN8313A and TLN8541A
406-420 & 450-470 MC "Motrac" Receivers
Motorola No. EPD-16533-C (T-2502C)
3/6/67-UP

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TLN1143A		ROUTING DATA FOR KEYING NO. 21 WAS: TO T6 AUDIO XFMR.	
B	TLN1143A		ADDED NOTES 2 & 3	NOTES

PARTS LIST

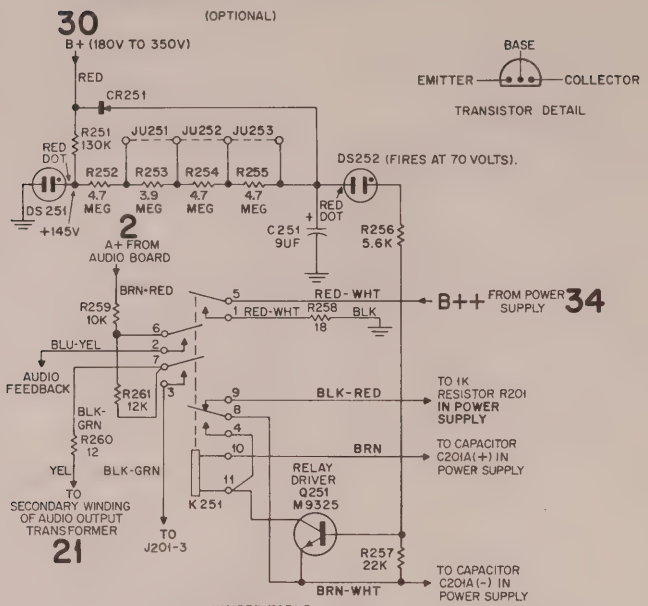
TLN8570A Time-Out Timer Board EPD-16394-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C251	23D83185D04	9 uf ±20%; 125 v
		SEMICONDUCTOR DEVICE, diode: (NOTE)
CR251	48D82466H18	silicon
		LAMP, incandescent:
DSC51	65C83543D01	139 v ±5 v @ 0.5 ma
DSC52	65B83542D01	52 to 62 v @ 0.4 ma
		RELAY, armature:
K251	80D83541D01	1 form "C"; 3 form "A"; 120 ohm
		TRANSISTOR:
Q251	48R869325	N-P-N; type M9325
		RESISTOR, ±5%; 1/2 w unl. stated
R251	6S127436	130K
R252, 254, 255	6S5586	4.7 meg
R253	6S488183	3.9 meg
R256	6S3940	5.6K
R257	6S6480	22K
R258	6S118238	10 ±10%; 2 w
R259	6S5556	10K
R260	6S118237	12 ±10%; 2 w
R261	6S129887	12K; 1/4 w

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

TIME-OUT TIMER

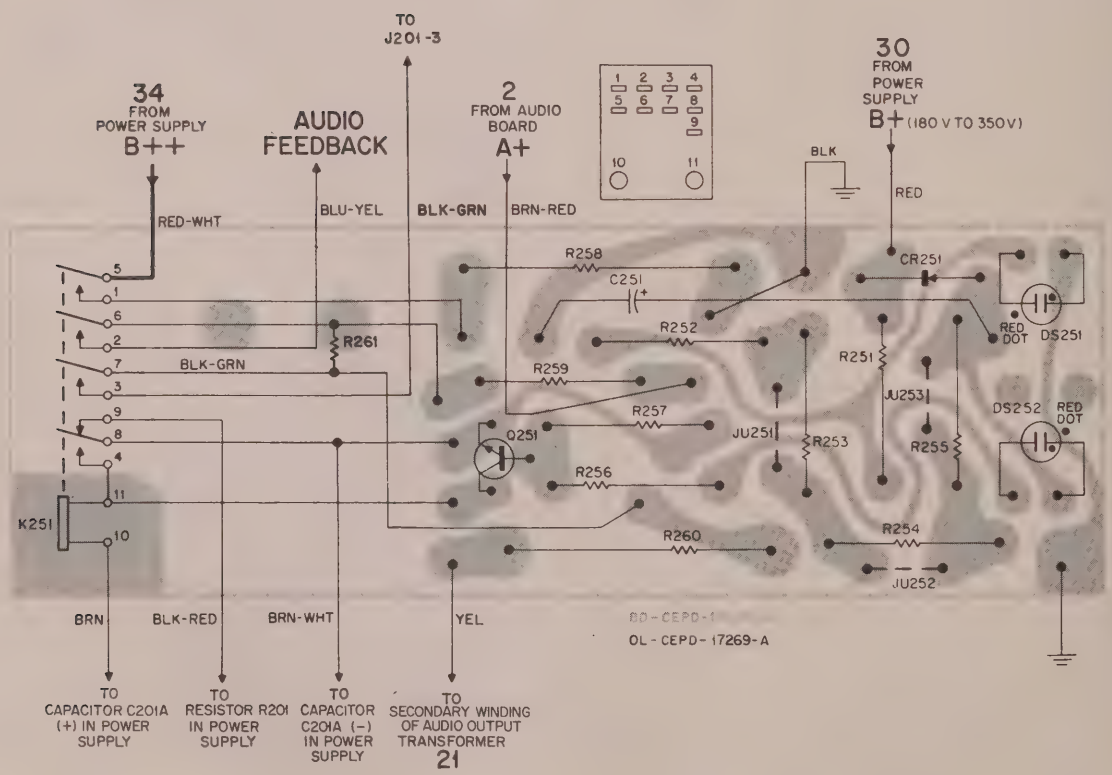


JUMPER TABLE

TIME	JU251	JU252	JU253
30 SEC	ADD	ADD	ADD
60 SEC	OMIT	ADD	ADD
90 SEC	OMIT	OMIT	ADD
120 SEC	OMIT	OMIT	OMIT

BEPD-17268-B

NOTE:
1. 20% DECREASE IN TIME-OUT TIME WHEN USED WITH POSITIVE GROUND OPERATION.
2. C251 CHARGES FROM 0 TO 70 VOLTS. SEE JUMPER TABLE FOR CHARGE TIME.
3. ALL VOLTAGES PRESENT ONLY WHEN TRANSMITTER IS KEYED AND BEFORE TIME-OUT.

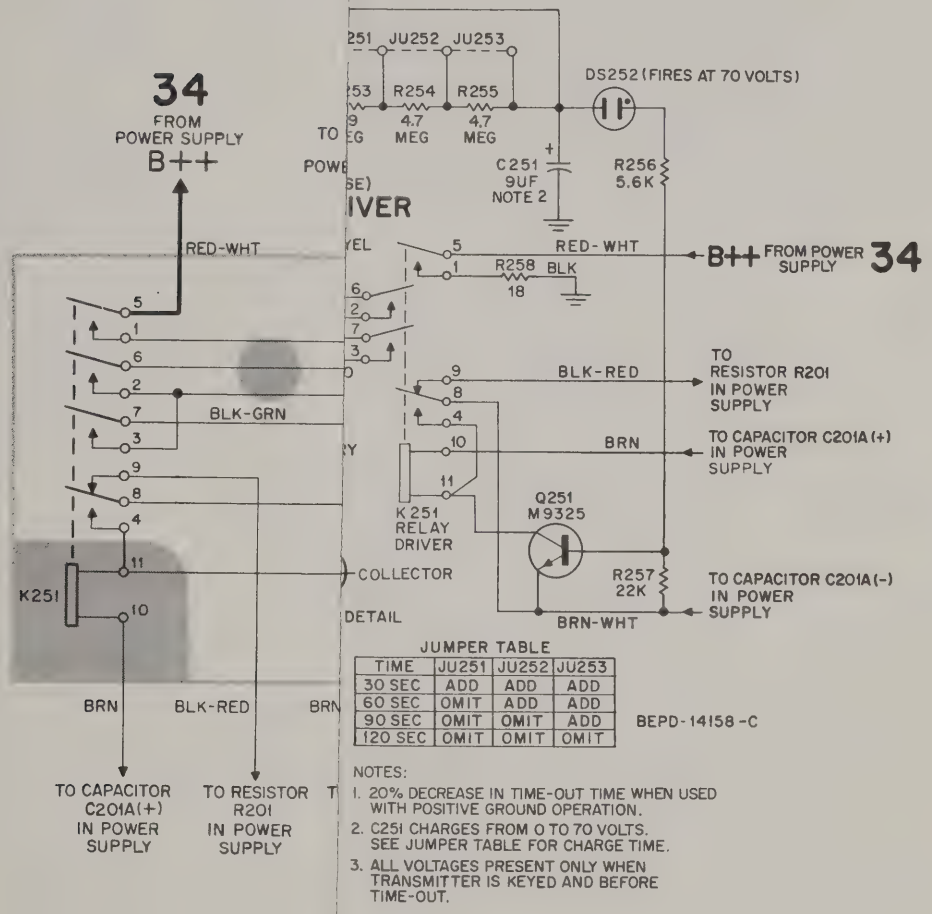


PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN1143A Time-Out Timer Schematic Diagram
And Circuit Board Detail for 450-470 MC "Motrac"
Radio Sets using the TLN8626A and TLN8525A
Audio & Squelch Circuit Boards
Motorola No. PEPD-17270-B (T-2580A)
5/5/67-UP

E-OUT TIMER

(OPTIONAL)



JUMPER TABLE

TIME	JU251	JU252	JU253
30 SEC	ADD	ADD	ADD
60 SEC	OMIT	ADD	ADD
90 SEC	OMIT	OMIT	ADD
120 SEC	OMIT	OMIT	OMIT

BEPD-14158-C

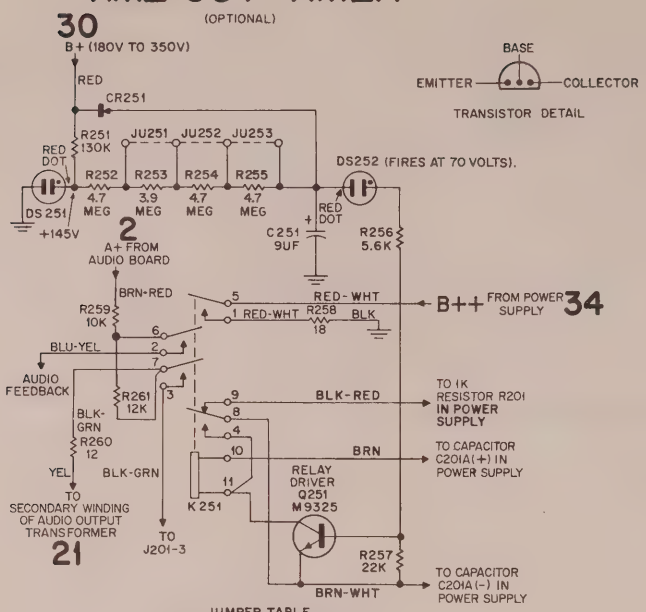
NOTES:

1. 20% DECREASE IN TIME-OUT TIME WHEN USED WITH POSITIVE GROUND OPERATION.
2. C251 CHARGES FROM 0 TO 70 VOLTS. SEE JUMPER TABLE FOR CHARGE TIME.
3. ALL VOLTAGES PRESENT ONLY WHEN TRANSMITTER IS KEYED AND BEFORE TIME-OUT.

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN1108A Time-Out Timer Schematic Diagram And Circuit Board Detail for 450-470 MC "Motrac" Radio Sets using the TLN8268A Audio & Squelch Circuit Board
Motorola No. EPD-15016-D (T-2546B)
3/21/67-UP

TIME-OUT TIMER

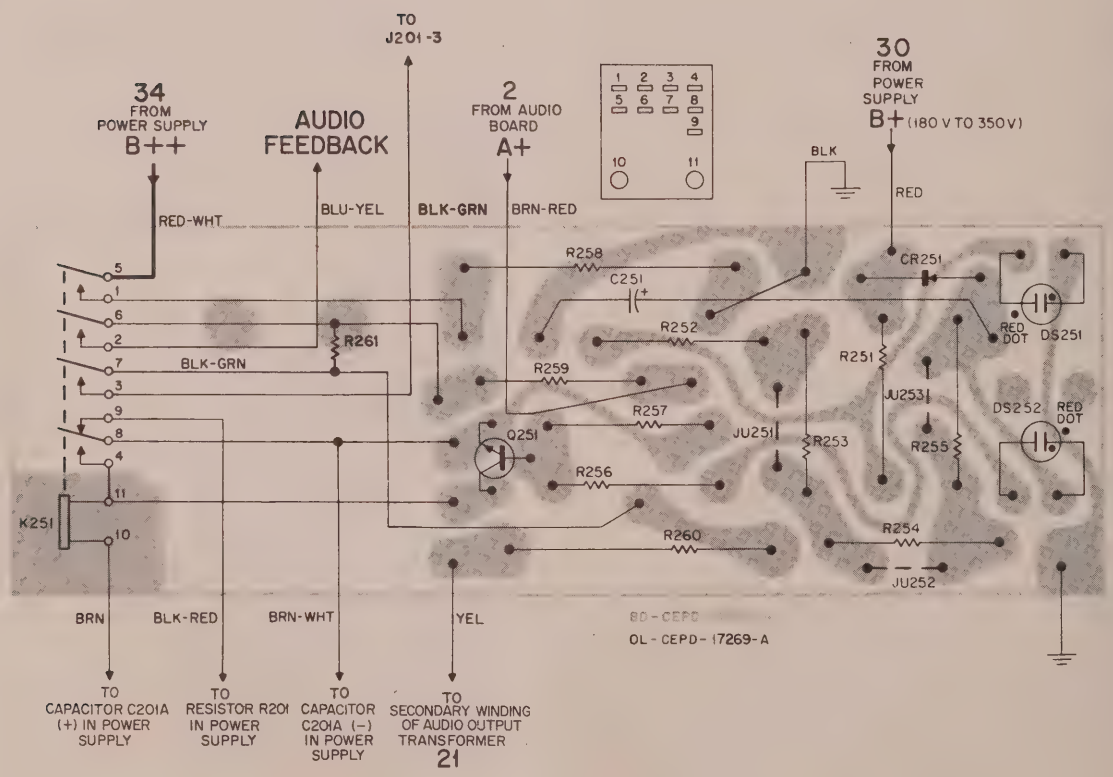


JUMPER TABLE

TIME	JU251	JU252	JU253
30 SEC	ADD	ADD	ADD
60 SEC	OMIT	ADD	ADD
90 SEC	OMIT	OMIT	ADD
120 SEC	OMIT	OMIT	OMIT

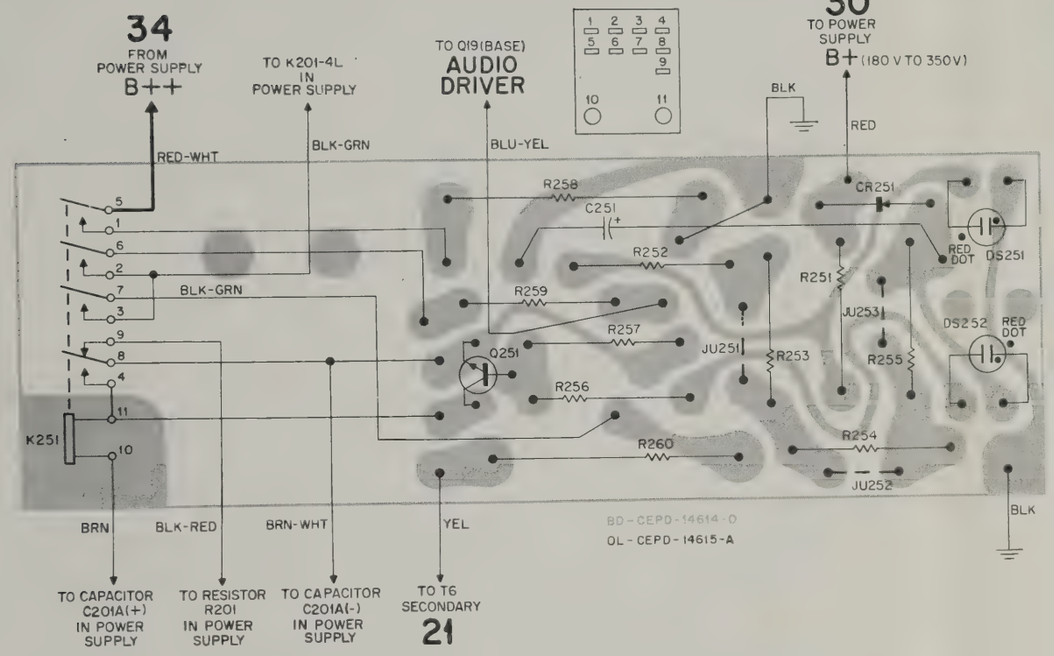
BEPD-17268-B

NOTE:
1. 20% DECREASE IN TIME-OUT TIME WHEN USED WITH POSITIVE GROUND OPERATION.
2. C251 CHARGES FROM 0 TO 70 VOLTS. SEE JUMPER TABLE FOR CHARGE TIME.
3. ALL VOLTAGES PRESENT ONLY WHEN TRANSMITTER IS KEYED AND BEFORE TIME-OUT.



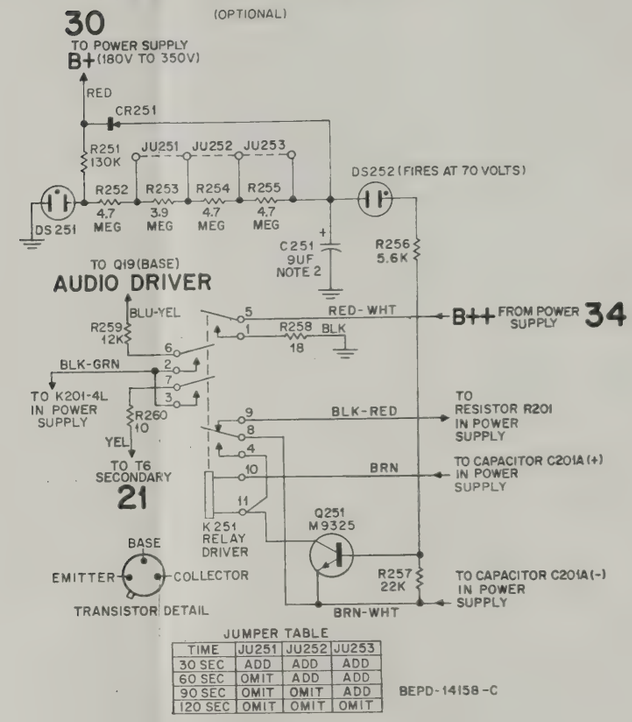
PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN1143A Time-Out Timer Schematic Diagram
And Circuit Board Detail for 450-470 MC "Motrac"
Radio Sets using the TLN8626A and TLN8525A
Audio & Squelch Circuit Boards
Motorola No. PEPD-17270-B (T-2580A)
5/5/67-UP



TIME-OUT TIMER

(OPTIONAL)



JUMPER TABLE

TIME	JU251	JU252	JU253
30 SEC	ADD	ADD	ADD
60 SEC	OMIT	ADD	ADD
90 SEC	OMIT	OMIT	ADD
120 SEC	OMIT	OMIT	OMIT

BEPD-14158-C

NOTES:

1. 20% DECREASE IN TIME-OUT TIME WHEN USED WITH POSITIVE GROUND OPERATION.
2. C251 CHARGES FROM 0 TO 70 VOLTS. SEE JUMPER TABLE FOR CHARGE TIME.
3. ALL VOLTAGES PRESENT ONLY WHEN TRANSMITTER IS KEYED AND BEFORE TIME-OUT.

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN1108A Time-Out Timer Schematic Diagram
And Circuit Board Detail for 450-470 MC
"Motrac" Radio Sets using the TLN8268A
Audio & Squelch Circuit Board
Motorola No. EPD-15016-D (T-2546B)
3/21/67-UP

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TLN1108A	R256	WAS 12 OHMS	PARTS LIST
B	TLN8468A-1	C251	WAS 23D82601A17; 15 uf +100-10%; 150 V	UPPER RIGHT OF SCHEMATIC
		R252	WAS 6R400228; 1.5 MEG	UPPER LEFT OF SCHEMATIC
		R253, 254	WERE 6R5779; 1.2 MEG	UPPER MIDDLE OF SCHEMATIC
		R255	WAS 6R5773; 820K	UPPER MIDDLE OF SCHEMATIC
		R256	WAS 6S6117; 5.6K; ±10%; 1/2 W	PARTS LIST
		R257	WAS 6S6397; 22K; ±10%; 1/2 W	
		R259	WAS 6S6394; 12K; ±10%; 1/2 W	
C	TLN1108A		USED ONLY WITH TLN8268A AUDIO & SQUELCH CIRCUIT BOARDS	
D	TLN1108A		ADDED VOLTAGES	SCHEMATIC DIAGRAM

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLN8468A Time-Out Timer Board EPD-14694-B

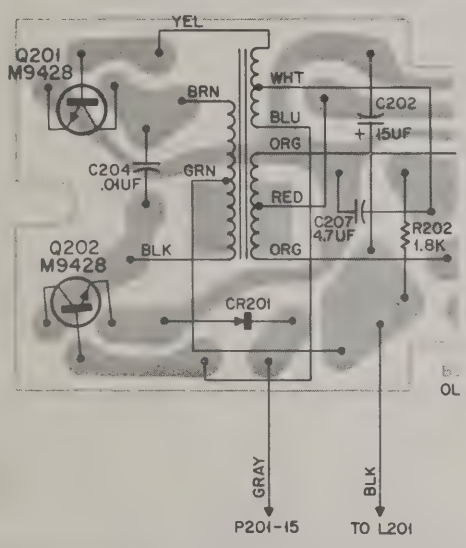
		CAPACITOR, fixed:
C251	23D83185D04	9 uf ±20%; 125 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR251	23D82601A17	silicon
		LAMP, glow: neon;
DS251	65C83543D01	type A-139
DS252	65B83542D01	type 3AG-B
		RELAY, armature:
K251	80D83541D01	3 form "A"; 1 form "C"
		TRANSISTOR: (SEE NOTE)
Q251	48R869325	N-P-N; type M9325
		RESISTOR, fixed: ±5%; 1/2 w; unl. stated
R251	6S127436	130K ±10%
R252, 254, 255	6S5586	4.7 meg
R253	6S488183	3.9 meg
R256	6S3940	5.6K
R257	6S6480	22K
R258	6S118238	18; 2 w
R259	6S2075	12K
R260	6R488033	10; 2 w

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TLN8482A	CR202	WAS 48C82466H21	PARTS LIST
		R202	WAS 6S128688, 2.7K	T201PRIMARY
		C203	REMOVED 21C82372C02 0.2 uf WAS CONNECTED IN PARALLEL WITH C202	Q201 EMITTER
		C206	REMOVED 21C82372C02 0.2 uf WAS CONNECTED IN PARALLEL WITH C205	T201 SECONDARY
B	TLN8482A-1	C207	ADDED 4.7 uf	Q202 EMITTER
C	TLN8482A-2	R204	WAS 6S129235, 1.2K	Q204 EMITTER
D	TLN8482A-3		RELOCATED C207 AND REVISED CIRCUIT BOARD PLATING. CIRCUIT WAS AS SHOWN BELOW.	

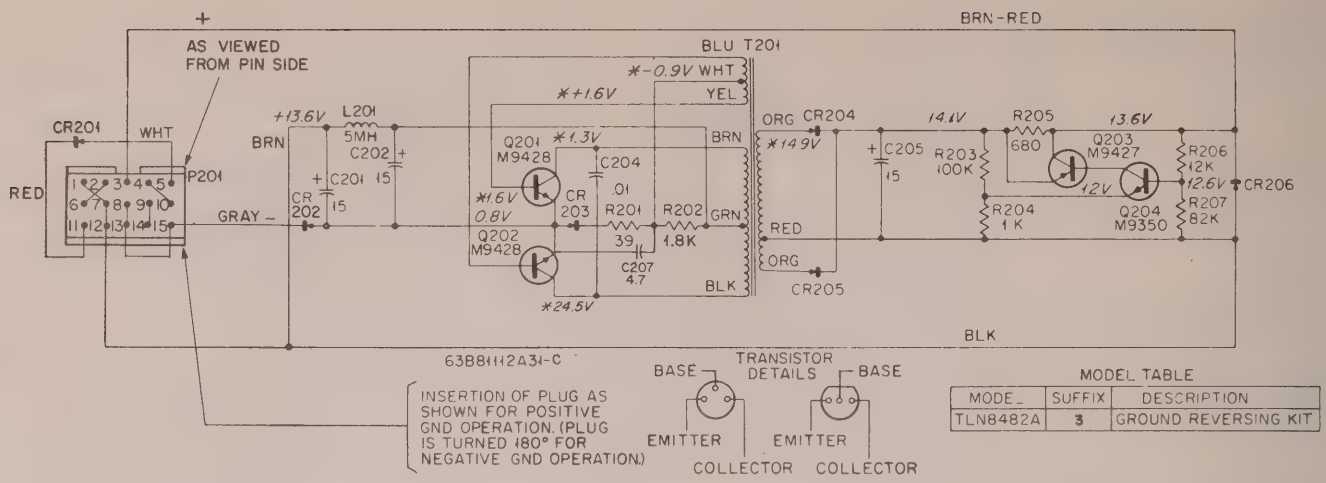


PARTS LIST

TLN8482A Ground Reversing Kit EPD-14846-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf
C201, 202, 205	23K865136	15 ±20%; 25 v
C204	21D82428B40	.01 +60-40%; 250 v
C207	23K865137	4.7 ±20%; 25 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR201	48C82525G07	silicon
CR202	48C82466H01	silicon
CR204, 205	48C82466H12	silicon
CR203, 206	48C82392B03	silicon
		COIL, audio: choke
L201	25B82142H01	5 mh
		CONNECTOR, plug: ass'y;
P201	1V80735A23	male; 15 contact; includes 14C82141H01 INSULATOR, 29C82335A01 TERMINAL
		TRANSISTOR: (SEE NOTE)
Q201, 202	48R869428	N-P-N; type M9428
Q203	48R869427	P-N-P; type M9427
Q204	48R869350	N-P-N; type M9350
		RESISTOR, fixed: ±10%; 1/4 w; unl. stated
R201	6S131652	39
R202	6S129269	1.8K
R203	6S129226	100K
R204	6K127802	1K
R205	6S6040	680; 1/2 w
R206	6S129230	12K
R207	6S129145	82K
		TRANSFORMER:
T201	25D83633D01	pri. No. 1: BLU, YEL w/center tap @ WHT; total coil res. .087 ohms pri. No. 2: BRN, BLK w/center tap @ GRN; total coil res. 0.16 ohms sec: ORG, ORG w/center tap @ RED; total coil res. 0.339

NOTE:
Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.



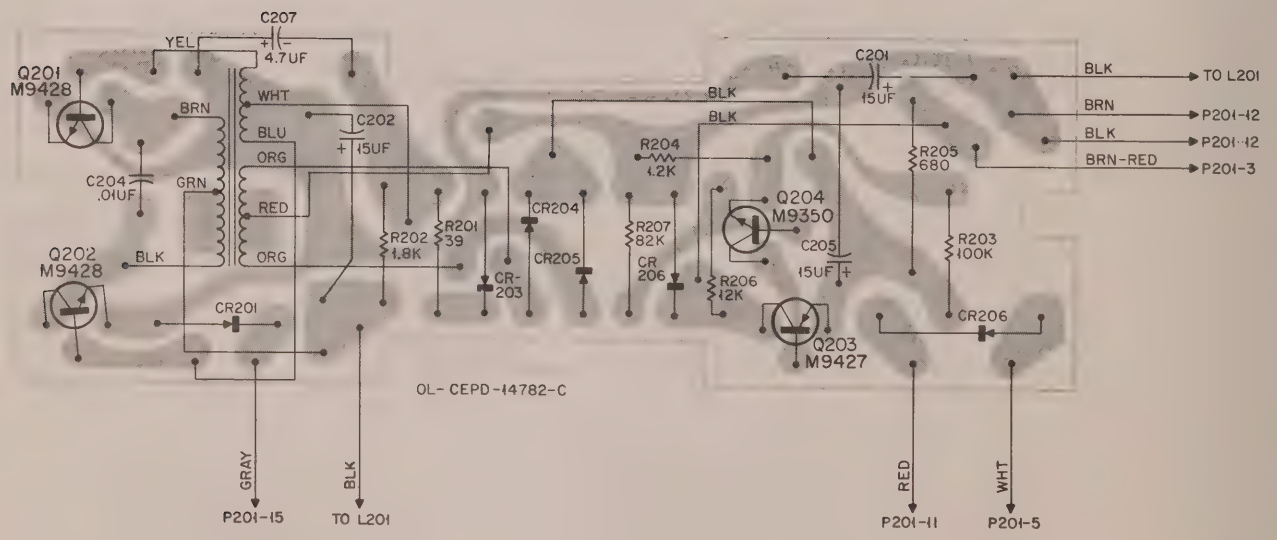
MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
TLN8482A	3	GROUND REVERSING KIT

NOTES:

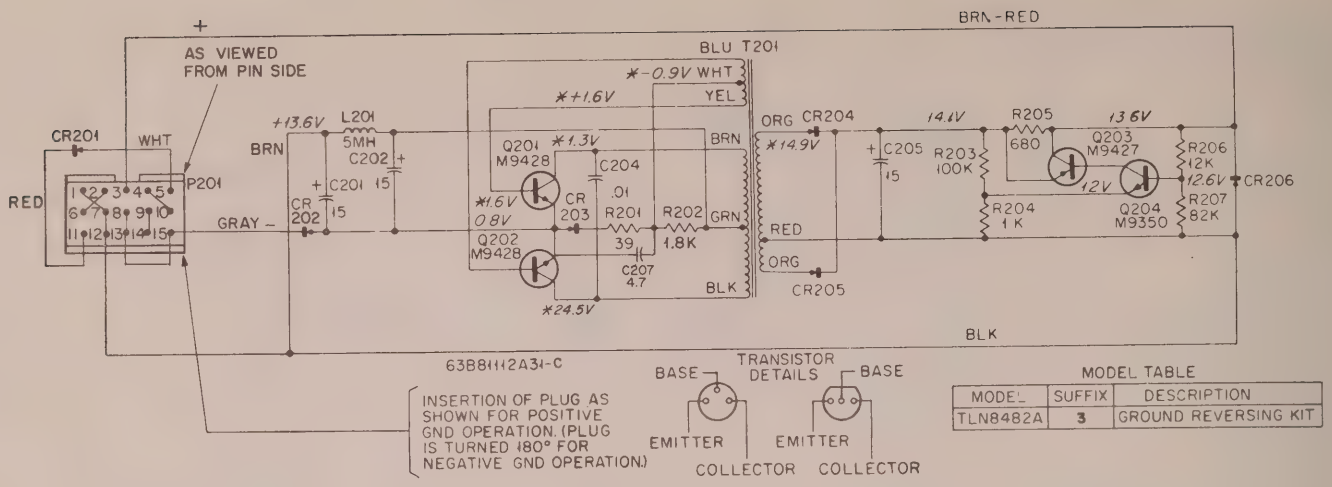
1. ALL RESISTANCES ARE IN OHMS, ±10%. ALL CAPACITANCES ARE IN MICROFARADS.
2. CHOKE L201 IS NOT MOUNTED ON THE PRINTED CIRCUIT BOARD.
3. ALL PRIMARY CIRCUIT VOLTAGES ARE MEASURED WITH RESPECT TO PIN 15.
4. ALL SECONDARY CIRCUIT VOLTAGES ARE MEASURED WITH RESPECT TO PIN 12.
5. VOLTAGES MARKED WITH AN ASTERISK (*) ARE MEASURED WITH AN OSCILLOSCOPE.
6. SEE PARTS LIST FOR RESISTOR WATTAGE RATINGS.

EPD-14784-A



PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Model TLN8482A Ground Reversing Kit
Schematic Diagram and
Printed Circuit Board Detail
Motorola No. EPD-14830-D
4/28/67-UP



MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
TLN8482A	3	GROUND REVERSING KIT

NOTES:

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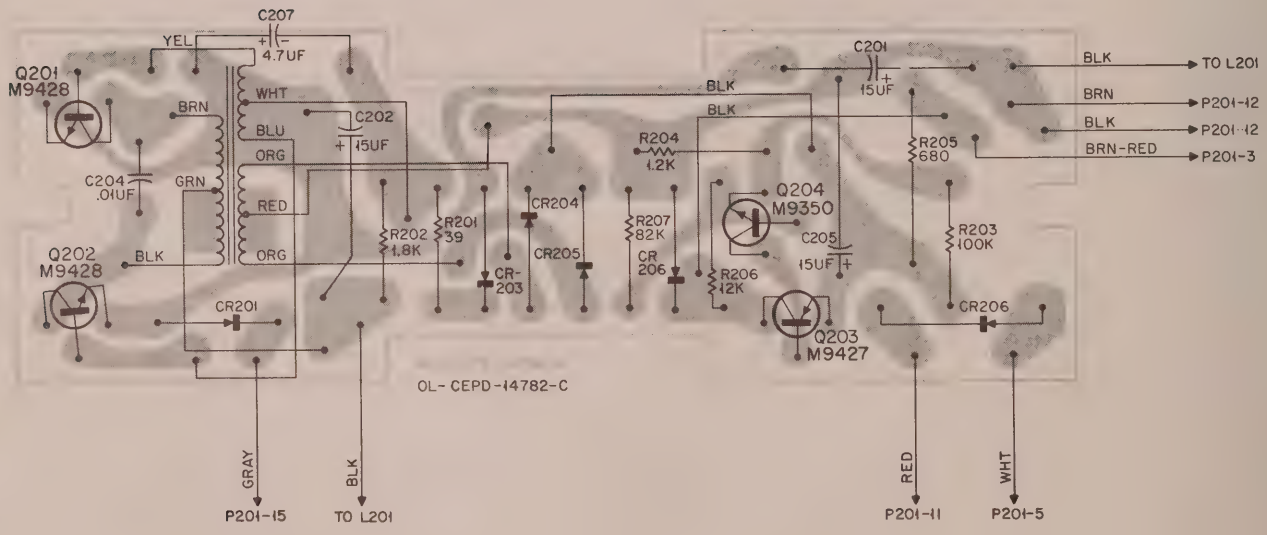
6. SEE PARTS LIST FOR RESISTOR WATTAGE RATINGS.

EPD-14784-A



PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Model TLN8482A Ground Reversing Kit
Schematic Diagram and
Printed Circuit Board Detail
Motorola No. EPD-14830-D
4/28/67-UP

TRANSMITTER PRE-ALIGNMENT NOTES

A. EXCERPTS FROM FCC REGULATIONS

FCC regulations state that:

1. Radio transmitters may be tuned or adjusted only by persons holding a 1st or 2nd class commercial radiotelephone operator's license or by personnel working under their immediate supervision.
2. The r-f power output of a radio transmitter shall be no more than that required for satisfactory technical operation considering the area to be covered and the local conditions.
3. Frequency and deviation of a transmitter must be checked before it is placed in service and re-checked once each year thereafter.

B. TEST EQUIPMENT REQUIRED

1. Motorola Model S1056A-9A Portable Test Set with a Motorola Model TKN6025A Adapter Cable (available on separate order). A 0-50 microampere meter with 20,000 ohms equivalent series resistance may be used if a test set is not available.
2. Motorola Model TLN6845A Tuning Tool Kit.
3. Bird Model 43."Thruline" RF Wattmeter and Motorola Model T1013A RF Load Resistor or equivalent.
4. Motorola Model T1012A Power Supply (or equivalent).

C. HOW TO SET UP THE S1056A-9A PORTABLE TEST SET

1. Set function selector switch to XMTR. position.
2. Place the oscillator and meter reversing switch in the OFF position.
3. Connect the 20-pin meter cable plug to the test set; connect the adapter cable to the cable coming from the test set; connect the other end of the adapter cable to the transmitter metering socket. When the test set is not being used, disconnect the 20-pin metering cable to conserve internal battery life. The plug on the cable acts as an on-off switch completing the battery circuit.

D. HOW TO KEY THE TRANSMITTER

Key the transmitter with the XMTR. ON switch on the test set or by talking into a microphone plugged into the test set or radio set control head. The transmitter may also be keyed by shorting the KEY contact to ground.

CAUTION

Do not key the transmitter for more than a few seconds at a time until it is properly tuned. Plate current is excessive in untuned stages and may cause damage. Turn on the transmitter for brief periods while reading the meter and making the adjustments.

E. FREQUENCY CALCULATIONS

crystal frequency in mc $\longrightarrow f_o = \frac{f_c}{36} \longleftarrow$ carrier frequency in mc

F. "IDC" CONTROL SETTING

(Transmitter Deviation)

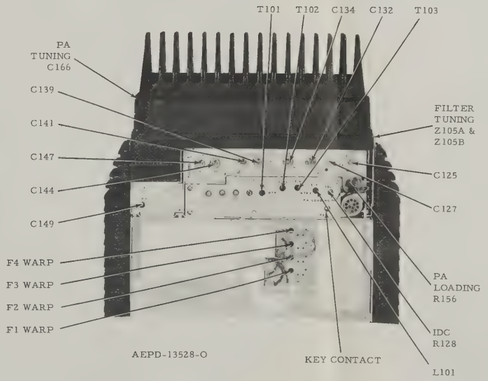
Refer to the reverse side of the Transmitter Alignment Procedure for setting of the IDC control.

G. PRELIMINARY ADJUSTMENTS

1. Connect the r-f wattmeter in series with the dummy load to the front panel antenna receptacle.
2. Set the PA LOADING rheostat to minimum.
3. Turn the equipment on and allow at least one minute for warm-up.

H. TRANSMITTER ADJUSTMENT

STEP	ADJUSTMENT	TEST SET SWITCH POSITION	STAGE AND TUNING PROCEDURE
1	PA LOADING R156	---	Set the PA LOADING potentiometer to minimum position (fully counterclockwise).
2	----	None	OSCILLATOR: FCC regulations require a periodic frequency check. If the check is due at this time, follow the OSCILLATOR FREQUENCY ADJUSTMENT procedure on this sheet; OTHERWISE NO ADJUSTMENT SHOULD BE MADE.
3	T101 T102 T103	---	Use hex end of tuning tool A. Set slugs to extreme counter-clockwise position. (Top of slug just visible above coil form.) Turn slugs in T101 and T102 clockwise about five turns. Turn slug in T103 about thirteen turns.
4	T101 T102 T103	1	MODULATOR 1ST DOUBLER COLLECTOR: Use hex end of tuning tool A. Tune T101 and T102 carefully for peak reading on meter. Tune T103 for peak meter reading.
5	L101	2	1ST TRIPLER GRID: Use hex end of tuning tool A. Tune L101 for peak meter reading. There may be two positions which give peak reading. Use the one that gives the highest reading on meter position 2.
6	C125 C127	3	1ST TRIPLER PLATE--2ND DOUBLER GRID: Use the blade end of tuning tool A. Tune C125, then C127 for a peak meter reading. Repeat. (With no signal at the grid of the stage being metered, the meter will read fixed bias.)
7	C132 C134	4	2ND DOUBLER PLATE--2ND TRIPLER GRID: Use blade end of tuning tool C. Tune C132, then C134 for a peak meter reading. Repeat. (With no signal at the grid of the stage being metered, the meter will read fixed bias.)
8	C139 C141	5	2ND TRIPLER PLATE--I.P.A. GRID: Use blade end of tuning tool C. Tune C139, then C141 for a peak meter reading. Repeat. (With no signal at the grid of the stage being metered, the meter will read fixed bias.)
9	C144 C147 C149	6	I.P.A. PLATE--COUPLING LINK--FINAL GRID: Use blade end of tuning tool C. Tune C144, then C147, then C149 for a peak meter reading. Repeat. (With no signal at the grid of the stage being metered, the meter will read fixed bias.)
10	PA TUNING C166	---	PA PLATE: Use blade end of tuning tool A. Adjust PA TUNING for peak r-f output. The final power amplifier plate tank capacitor (C166) must be retuned after the transmitter has been keyed for at least two minutes. The capacitor is tuned for peak power output, and then detuned 1 watt for 20 and 40 watt models and 2 watts for 60 watt models by turning the capacitor shaft clockwise, i.e., in toward the final tube. If a field strength meter is used, it should be detuned 2% of at least a three quarter scale reading on the field strength meter by the same method. Use r-f wattmeter or field strength meter.
11	FILTER TUNING Z105	---	HARMONIC FILTER: Use slotted end of tuning tool B. Tune FILTER TUNING adjustments Z105A and Z105B for maximum power output. Repeat PA TUNING and repeat tuning Z105A and Z105B.
12	PA LOADING R156	---	FINALIZING ADJUSTMENTS: Use blade end of tuning tool A. Carefully repeak all adjustments, steps 3-11. Calculate the d-c power input as follows: $P_{in} = I_p \times E_p$. I_p is PA position reading (0-50 ua scale) times 10,000. E_p is position 9 reading (0-1000 v d-c scale) on the test set. The final plate power input is controlled by the PA LOADING rheostat. If P_{in} exceeds 180 watts (120 watts in 40-watt models, 60 watts in 20-watt models) reduce I_p by adjusting PA LOADING rheostat. Repeak Z105A and Z105B after the PA LOADING adjustment. DO NOT ADJUST PA LOADING RHEOSTAT FOR MORE THAN 60, 120 OR 180 WATTS INPUT TO FINAL (20-watt, 40-watt or 60-watt radios, respectively).



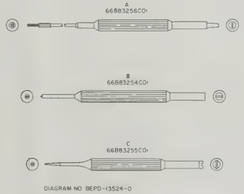
I. FINAL METER READINGS

1. Each time a transmitter is aligned or tested, final meter readings should be made and entered in a logbook.
2. All readings given in the table below are minimum except PA which is maximum. DO NOT exceed the value given for the PA current. This is the maximum plate current to which the unit can be safely tuned. Multiply the microampere scale reading by 10 to obtain actual PA plate current in milliamperes.
3. Readings 1 through 6 are purely relative and do not give actual current or voltage measurement.
4. Meter readings are obtained with 13.4 v d-c input at the battery terminals.

CIRCUIT METERED	1st Doubler Collector	1st Tripler Grid	2nd Doubler Grid	2nd Tripler Grid	I.P.A. Grid	PA Grid	PA Plate Current	PA Plate Voltage	Power Output
SWITCH POSITION*	1	2	3	4	5	6	7	8	
METER READING	15	15	15	15	15	15	2.5 3.7 13.7	72v 44v	60 watts 40 watts 20 watts

*PO position reads same as position 1; do not use for power output.

TUNING TOOLS



J. OSCILLATOR FREQUENCY ADJUSTMENT

Setting the oscillator "on-frequency" is the only oscillator adjustment necessary. Do this as follows:

1. Allow the channel element temperature to stabilize at 25°C (77°F).
2. To adjust the TLN1083A Channel Element, use the Motorola Model T1130A Series FM Station Monitor, Model T1021B Portable Frequency Meter, or Model T1020A Frequency and Deviation Meter as a frequency standard. To adjust the TLN1087A Channel Element, use the Motorola Model S1075B Frequency Meter as a frequency standard. Set up the equipment for frequency measurement as described in the test equipment manual.
3. Key the transmitter with no modulation. Disconnect the microphone and key the transmitter with the portable test set or the KEY contact. On "Private-Line" tone-coded squelch models, disable the "Private-Line" tone generator by removing the "Vibrasender" resonant reed.
4. Adjust the F1 "WARP" capacitor for an "on-frequency" indication on the frequency standard. For multiple frequency models, adjust the F2, F3 and F4 "WARP" capacitors (frequency switch in corresponding position).

I. FINAL METER READINGS

ligned or tested, final meter readings should be made and entered

.e below are minimum except PA which is maximum. DO NOT ex-
PA current. This is the maximum plate current to which the unit
.y the microampere scale reading by 10 to obtain actual PA plate

ely relative and do not give actual current or voltage measurement.
with 13.4 v d-c input at the battery terminals.

d ub- r rid	2nd Trip- ler Grid	I. P. A. Grid	PA Grid	PA Plate Current	PA Plate Voltage	Power Output
3	4	5	6	7	9	
0	15	15	16	25	720	60 watts
				20	600	40 watts
				13.7	440	20 watts

tion 1; do not use for power output.

TUNING TOOLS

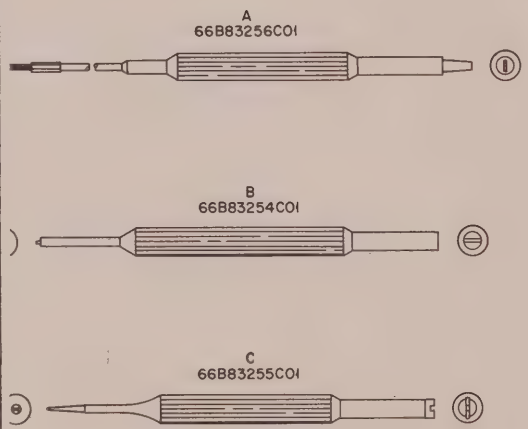


DIAGRAM NO. BEPD-13524-0

OSCILLATOR FREQUENCY ADJUSTMENT

quency" is the only oscillator adjustment necessary. Do this as fol-

it temperature to stabilize at 25°C (77°F).
Channel Element, use the Motorola Model T1130A Series FM Station
Portable Frequency Meter, or Model T1020A Frequency and Devia-
y standard. To adjust the TLN1087A Channel Element, use the
Frequency Meter as a frequency standard. Set up the equipment for
as described in the test equipment manual.
no modulation. Disconnect the microphone and key the transmitter
or the KEY contact. On "Private-Line" tone-coded squelch models,
e" tone generator by removing the "Vibrasender" resonant reed.
apacitor for an "on-frequency" indication on the frequency standard.
nodels, adjust the F2, F3 and F4 "WARP" capacitors (frequency
position).

DURE

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REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TLN8317A	R119	WAS 6S6048 47K ±10%	PARTS LIST
		R121, R124	WERE 6S6320, 10K ±10%	
		R122	WAS 6S2039, 68 OHMS ±10%	
		R127	WAS 6S2004, 8.2K ±10%	

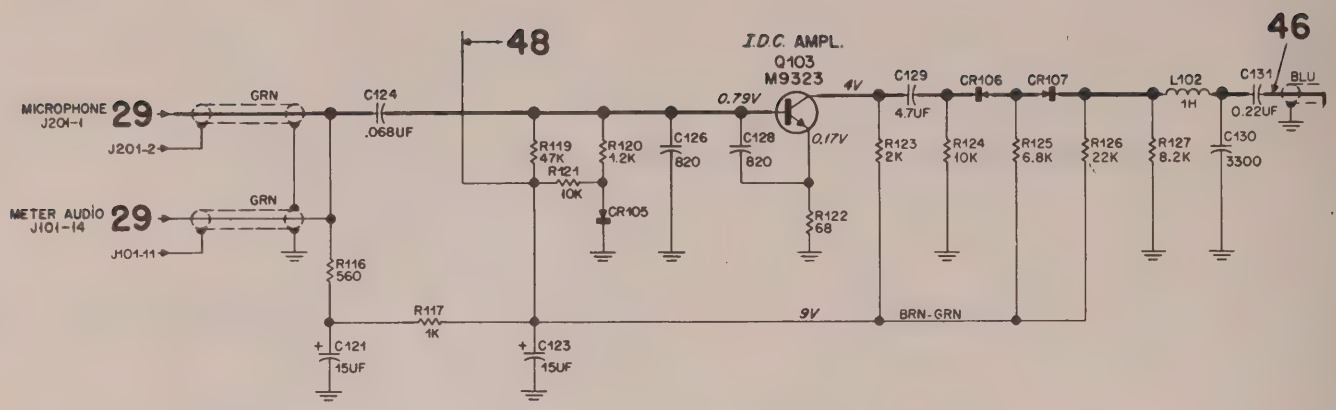
PARTS LIST

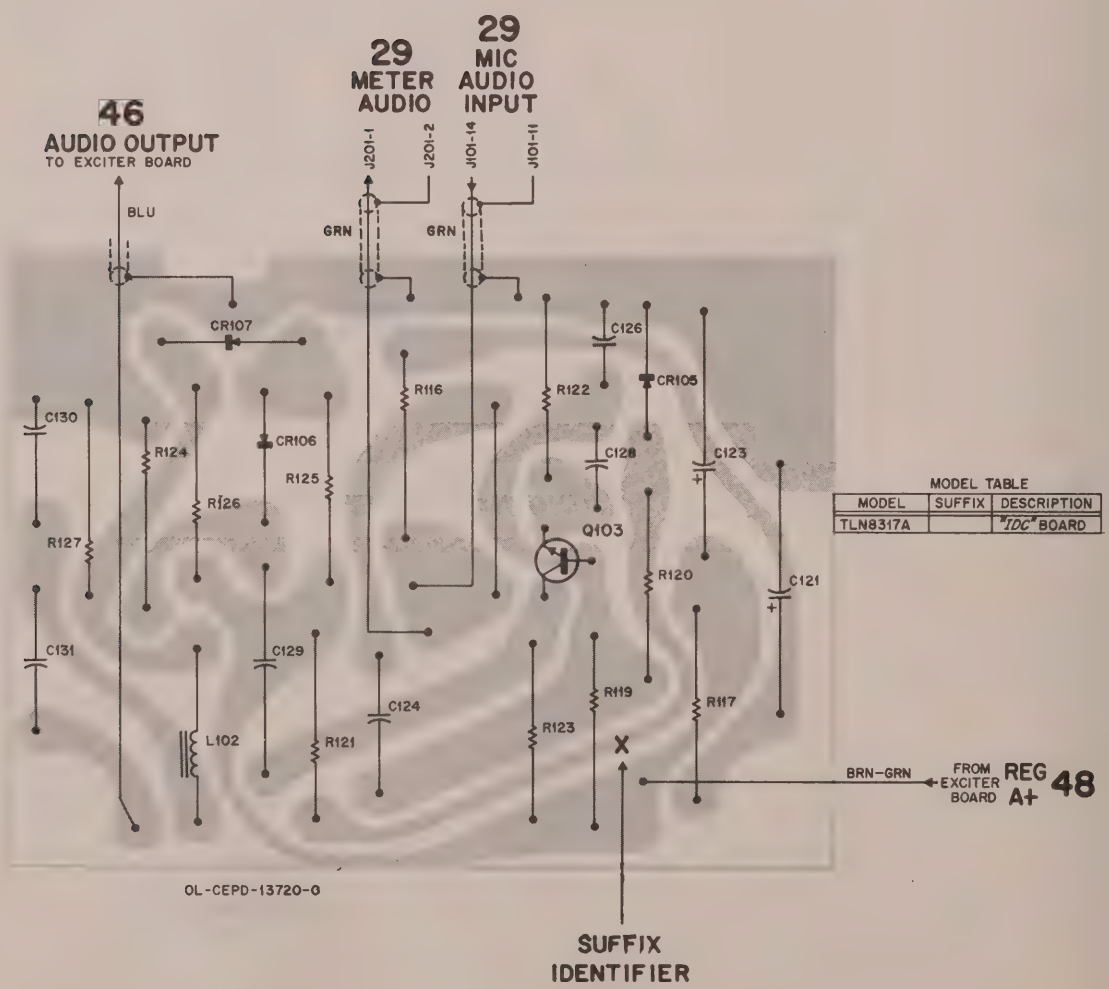
TLN8317A I.D.C. Board Kit EPD-15275-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf ±10%; 25 v; unl. stated
C121, 123	23K865136	15 ±20%
C124	8D82905G04	.068; 50 v
C126, 128	21D82187B17	820 uuf; 500 v
C129	23K865137	4.7 ±20%
C130	8D82905G25	.0033; 100 v
C131	8D82905G11	0.22; 50 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR105, 106, 107	48C82392B03	silicon
		COIL, audio:
L102	25D82113H02	choke; 1 h
		TRANSISTOR: (SEE NOTE)
Q103	48R869323	N-P-N; type M9323
		RESISTOR, fixed: ±5%; 1/2 w; unl. stated
R116	6S6291	560 ±10%
R117	6S6229	1K ±10%
R119	6S5772	47K
R120	6S6166	1.2K
R121, 124	6S5556	10K
R122	6S400424	68
R123	6S400060	2K
R125	6S2001	6.8K
R126	6S6480	22K
R127	6S400490	8.2K

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.



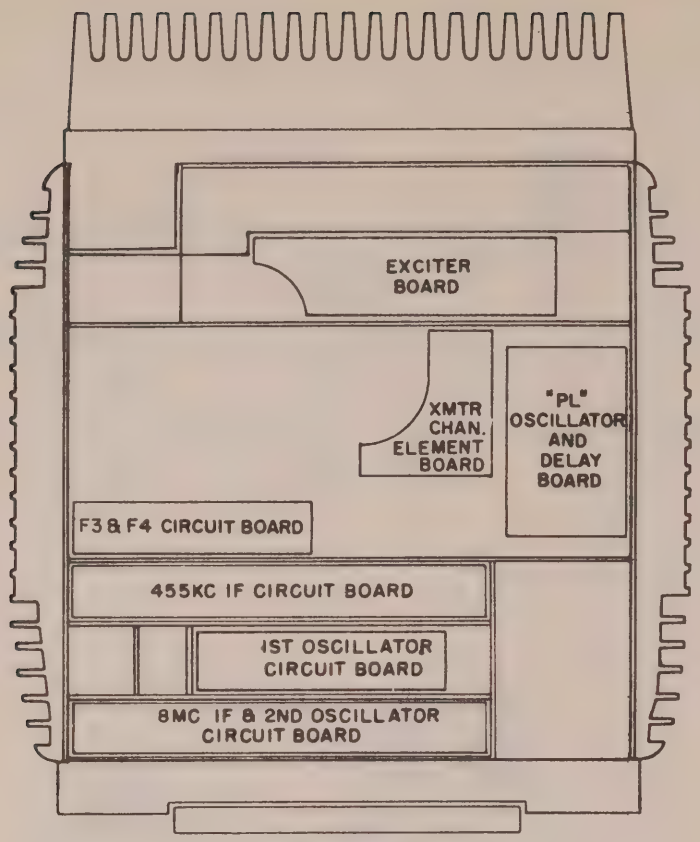


MODEL TABLE

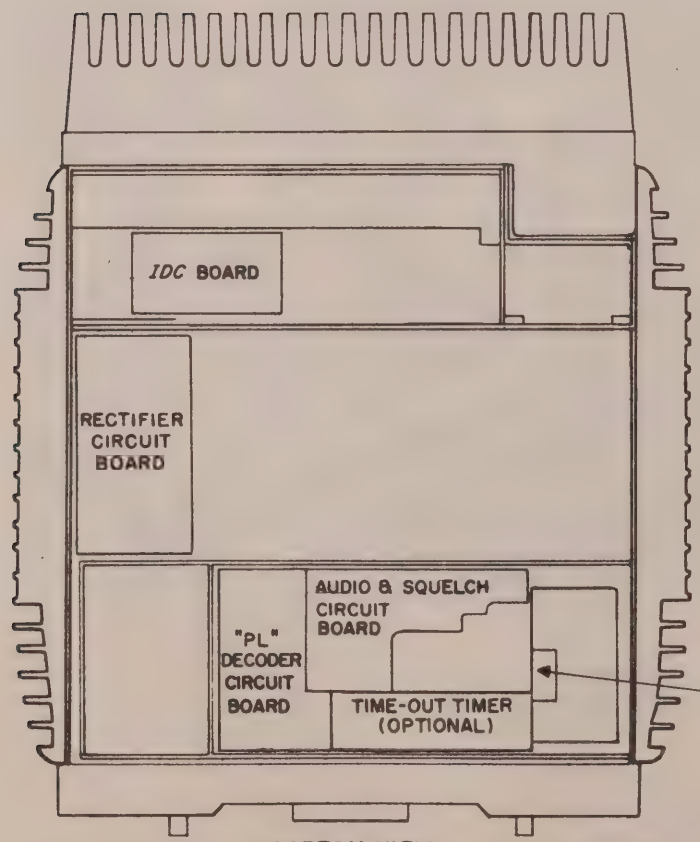
MODEL	SUFFIX	DESCRIPTION
TLN8317A		"IDC" BOARD

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

IDC Circuit Board Detail
Model TLN8317A, 450-470 MC
"Motrac" Radio Sets
Motorola No. EPD-13721-A (T-2568B)
7/15/68-UP


EXCITER BOARD
XMTR CHAN. ELEMENT BOARD
"PL" OSCILLATOR AND DELAY BOARD
F3 & F4 CIRCUIT BOARD
455KC IF CIRCUIT BOARD
1ST OSCILLATOR CIRCUIT BOARD
8MC IF & 2ND OSCILLATOR CIRCUIT BOARD

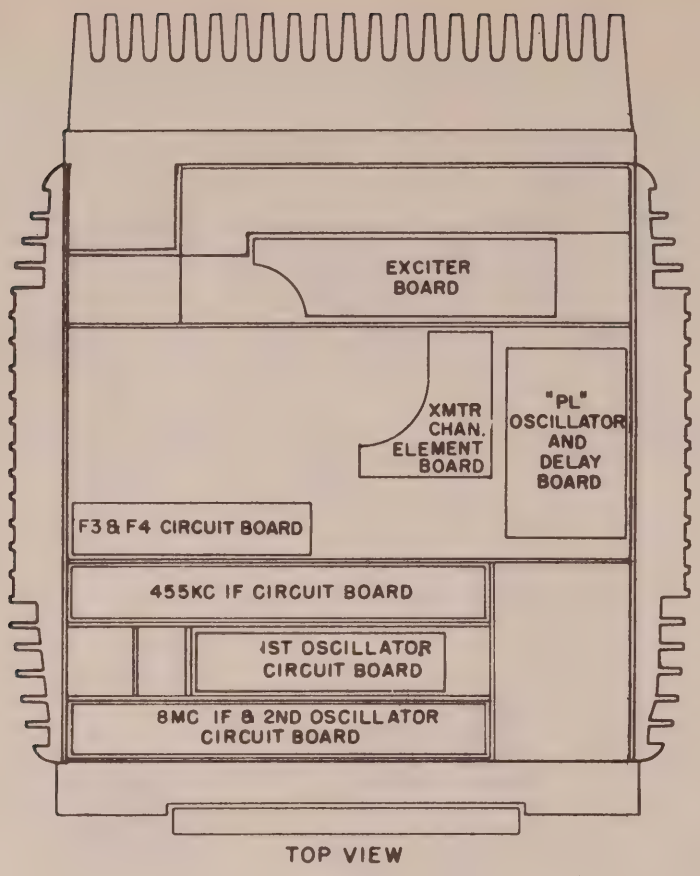
TOP VIEW


IDC BOARD
RECTIFIER CIRCUIT BOARD
"PL" DECODER CIRCUIT BOARD
AUDIO & SQUELCH CIRCUIT BOARD
TIME-OUT TIMER (OPTIONAL)
455KC FILTER AMPLIFIER CIRCUIT BOARD (ACCESSIBLE FOR SERVICE ON 25KC CHANNEL SPACING MODELS ONLY.)

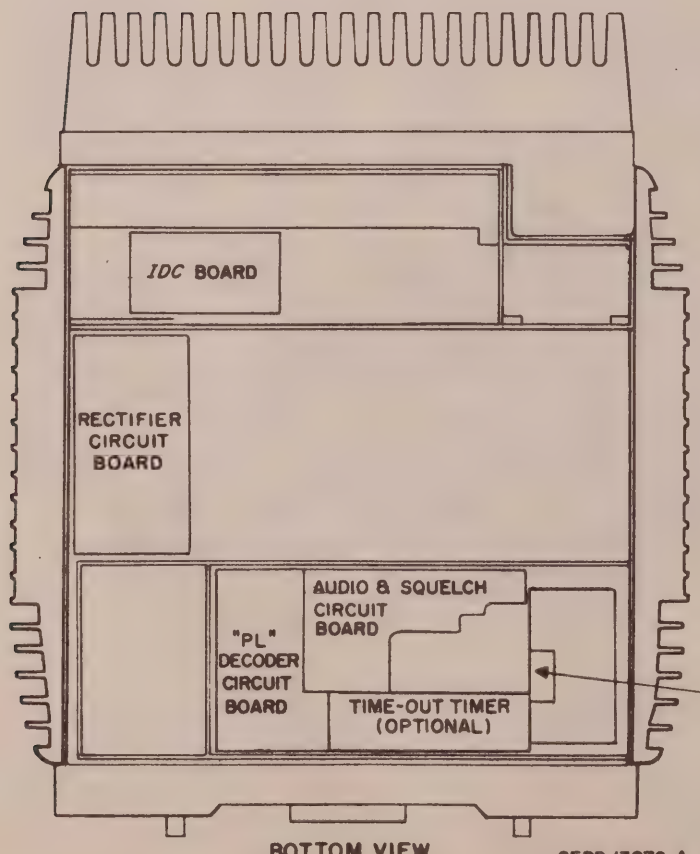
BOTTOM VIEW

CEPD 13876-A

Circuit Board Location Details
For 406-420 & 450-470 MC "Motrac" Radio Sets
Motorola No. CEPD-13876-A (T-2502K)
3/6/67-UP


EXCITER BOARD
XMTR CHAN. ELEMENT BOARD
"PL" OSCILLATOR AND DELAY BOARD
F3 & F4 CIRCUIT BOARD
455KC IF CIRCUIT BOARD
1ST OSCILLATOR CIRCUIT BOARD
8MC IF & 2ND OSCILLATOR CIRCUIT BOARD

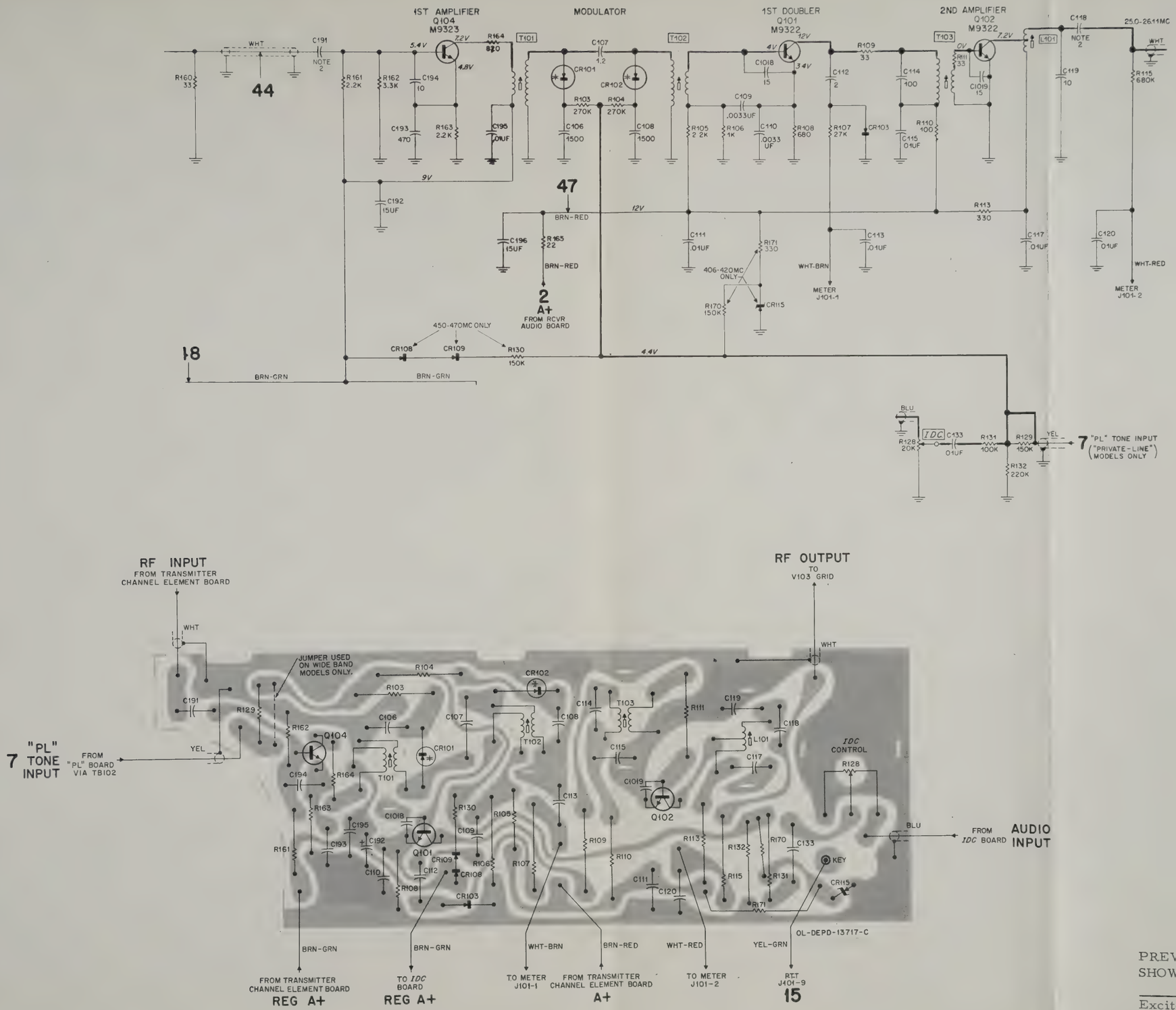
TOP VIEW


IDC BOARD
RECTIFIER CIRCUIT BOARD
"PL" DECODER CIRCUIT BOARD
AUDIO & SQUELCH CIRCUIT BOARD
TIME-OUT TIMER (OPTIONAL)
455KC FILTER AMPLIFIER CIRCUIT BOARD (ACCESSIBLE FOR SERVICE ON 25KC CHANNEL SPACING MODELS ONLY.)

BOTTOM VIEW

CEPD 13876-A

Circuit Board Location Details
For 406-420 & 450-470 MC "Motrac" Radio Sets
Motorola No. CEPD-13876-A (T-2502K)
3/6/67-UP



PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Exciter Circuit Board Detail
Models TLE6156A-2 and TLE6157A-1
406-420 & 450-470 MC "Motrac" Radio Sets
Motorola No. EPD-13718-D (MR-2163A)
7/5/67-UP

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TLE6157A	R103	WAS REFERENCED - R104	UPPER LEFT OF EXCITER BOARD
B	TLE6156A		ADDED	PARTS LIST & SCHEMATIC
C	TLE6156A-1 TLE6157A-1	C1018, C1019	ADDED 15 uuf	Q101, Q102
D	TLE6156A-2	C118	WERE 21D82187B10, 270 uuf	RIGHT SIDE OF BOARD
		C191		LEFT SIDE OF BOARD
		CR108, 109	(TLE6157A ONLY) LEGEND ADDED	PARTS LIST & DIAGRAM
		R130		
		CR115	DIODE ADDED	LOWER RIGHT OF BOARD
		R170	ADDED 150K	
		R171	ADDED 330 OHMS	

PARTS LIST

TLE6156A Exciter Kit (406-420 MC)
TLE6157A Exciter Kit (450-470 MC) EPD-15273-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf; ±10%; 500 v; unl. stated
C106, 108	21D82187B18	1500; 1000 v
C107	21C82450B08	1.2 ±5%
C109, 110	21D82428B10	.0033 uf; 100 v
C111, 120	21D82428B58	.01 uf +80-20%
C112	21D82133G37	2 ±0.25 uuf; NP0
C113, 115, 117, 195	21D82428B59	.01 uf +80-20%; 200 v
C114	21D82610C44	100 ±5%; 100 v; N220 (TLE6157A)
	or21D82610C09	120 ±5%; N220 (TLE6156A)
C118, 191	21D82187B10	270 (TLE6157A)
	or21C82428B59	.01 uf +80-20%; 200 v (TLE6156A)
C119	21D82133G81	10; N1500 (TLE6157A)
	or21D82204B19	20 ±5%; N1500 (TLE6156A)
C133	8D82905G07	0.1 uf; 50 v
C192	23K865136	15 uf ±20%; 25 v
C193	21C82187B07	470
C194	21D82133G01	10 ±5%; NP0
C1018, 1019	21K840846	15 ±5%; NP0
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR101, 102	48C82190H02	silicon; varactor type
CR103	48C82921G01	germanium
CR108, 109	48C82392B03	silicon (TLN6157A only)
CR115	48D82256C56	silicon; zener type (TLN6156A only)
		COIL, RF:
L101	24V80905A27	RED DOT; incl. 76C82098H01 CORE, tuning
		TRANSISTOR: (SEE NOTE)
Q101, 102	48R869322	N-P-N; type M9322
Q104	48R869323	N-P-N; type M9323
		RESISTOR ±5%; 1/2 w; unl. stated
R103, 104	6S2050	270K
R105, 161, 163	6S128689	2.2K ±10%; 1/4 w
R106	6S6229	1K ±10%
R107	6S5786	27K
R108	6S128599	680 ±10%; 1/4 w
R109, 111	6S2036	33 ±10%
R110	6S6326	100 ±10%
R113	6S6022	330 ±10%
R115	6S5775	680K
R128	18D82238D14	var; 20K; 1/4 w
R129	6S128683	150K; 1/4 w
R130	6S5559	150K (TLN6157A only)
R131	6S5553	100K
R132	6S400066	220K
R162	6S129231	3.3K ±10%; 1/4 w
R164	6S129432	820 ±10%; 1/4 w
R170	6S128683	150K; 1/4 w (TLE6156A only)
R171	6S129806	330; 1/4 w (TLE6156A only)
		TRANSFORMER:
T101, 102	24V80903A21	coded GRAY-ORG incl. 76B82611C02 CORE, tuning; (TLE6157A)
	or24V80903A26	coded ORG-RED incl. 76B82611C02 CORE, tuning; (TLE6156A)
T103	24V80905A26	GRN DOT; incl. 76C82098H01 CORE, tuning
NON-REFERENCED ITEMS		
	1V80737A35	SHIELD ASSY. (Used with T101, T102)
	26A82076C03	SHIELD (Used with L101, T103)

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

A. TEST EQUIPMENT REQUIRED

1. Motorola Model S1056A-9A Portable Test Set with a Motorola Model TKN6025A Adapter Cable (available on separate order) must be used. A 0-50 microampere meter with 20,000 ohms equivalent series resistance may be used if a test set is not available.
2. Motorola Model T1034C Signal Generator (or equivalent).
3. Motorola Model TLN6845A Tuning Tool Kit. A small screwdriver may be used for some of the alignments.
4. Motorola Model T1012A Power Supply (or equivalent).

B. HOW TO SET UP THE S1056A-9A PORTABLE TEST SET

1. Set function selector switch to RCVR position.
2. Switch on 455 kc crystal oscillator.
3. Connect the 20-pin meter cable plug to the test set; connect the adapter cable to the cable coming from the test set; connect the other end of the adapter cable to the receiver metering socket. When the test set is not in use; disconnect the 20-pin metering cable to conserve internal battery life. The plug on the cable acts as an on-off switch completing the battery circuit.
4. Connect the r-f extension cable to the test set; connect the r-f probe cable to the r-f extension cable.

C. HOW TO SET UP THE SIGNAL GENERATOR FOR 8 MC IF ALIGNMENT

1. Set up the signal generator according to the instructions supplied with the unit.
2. Remove the first oscillator channel element(s).
3. Connect the signal through a 0.003 uf capacitor to POINT 2 (8 mc i-f amplifier) as shown on the photo. (Generator output cable terminated in 50 ohms.)
4. Switch the test set to meter position 4.
5. Rotate the signal generator dial back and forth near the 8 mc reading. Watch the test set meter. The pointer should swing above and below the zero reading as the dial is rotated. Set the dial to absolute zero meter reading.

D. HOW TO SET UP THE SIGNAL GENERATOR FOR RF ALIGNMENT

1. Set up the signal generator according to the instructions supplied with the unit.
2. Connect the signal generator cable to the antenna input.
3. Turn the generator output up to maximum.
4. Keep the test set in position 4.
5. Rotate the signal generator dial back and forth near the assigned r-f carrier frequency. Watch the test set meter. The pointer should swing above and below the zero reading as the dial is rotated. Set the dial for exact zero meter reading. Be sure the generator frequency is kept at zero meter reading.

E. HOW TO MEASURE 20 DB QUIETING SENSITIVITY

Test Equipment Required

1. Motorola Model T1034C Signal Generator
2. Motorola Model S1056A-9A

Procedure

1. Turn on the signal generator and allow it to warm up for at least one hour.
2. Connect the meter cable from the test set to the receiver METER receptacle on the chassis.
3. Set the RCVR-XMTR-ACCESS switch to the RCVR position. Set the position selector to position 4.
4. Connect the signal generator output through a 6 db pad to the ANT jack on the radio set.
5. Turn up the generator output and rotate the generator dial back and forth near the assigned r-f carrier frequency. The test set meter pointer should swing above and below the zero mark as the generator dial is rotated. Set the dial for exact zero reading.
6. Reduce the signal generator output to zero (i.e., no signal input). Set the position selector switch to position 11 (AUDIO).
7. Unsquelch the receiver by turning the control head SQUELCH control fully counterclockwise.
8. Adjust the VOLUME control, located on the control head, for a 1.0 volt reading on the test set meter.
9. Now, turn up the signal generator output until the test set meter reading drops to 0.1 volt. Note the setting of the signal generator output control. This value (less 6 db for the attenuation of the pad) in microvolts is the 20 db quieting sensitivity for the receiver.

F. TEST SET SELECTOR SWITCH POSITIONS

S1056A-9A TEST SET	1	2	4	5	6	11
CIRCUIT METERED	455 KC IF Ampl. #1	455 KC IF Ampl. #3	Discrim. Secondary	Discrim. Primary	1st. Osc.	Audio

G. FREQUENCY CALCULATIONS

$$f_{o1} = \frac{f_c - 8\ MC}{27}$$

where: f_{o1} = 1st oscillator crystal frequency

f_c = carrier frequency

TUNING TOOLS

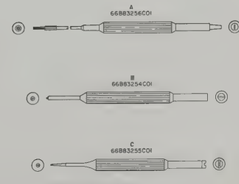
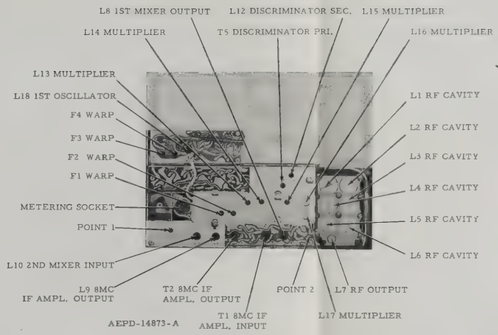


DIAGRAM NO. BEPD-13524-O



AVERAGE STAGE MEASUREMENTS ON REVERSE SIDE OF THIS SHEET

H. RECEIVER ALIGNMENT

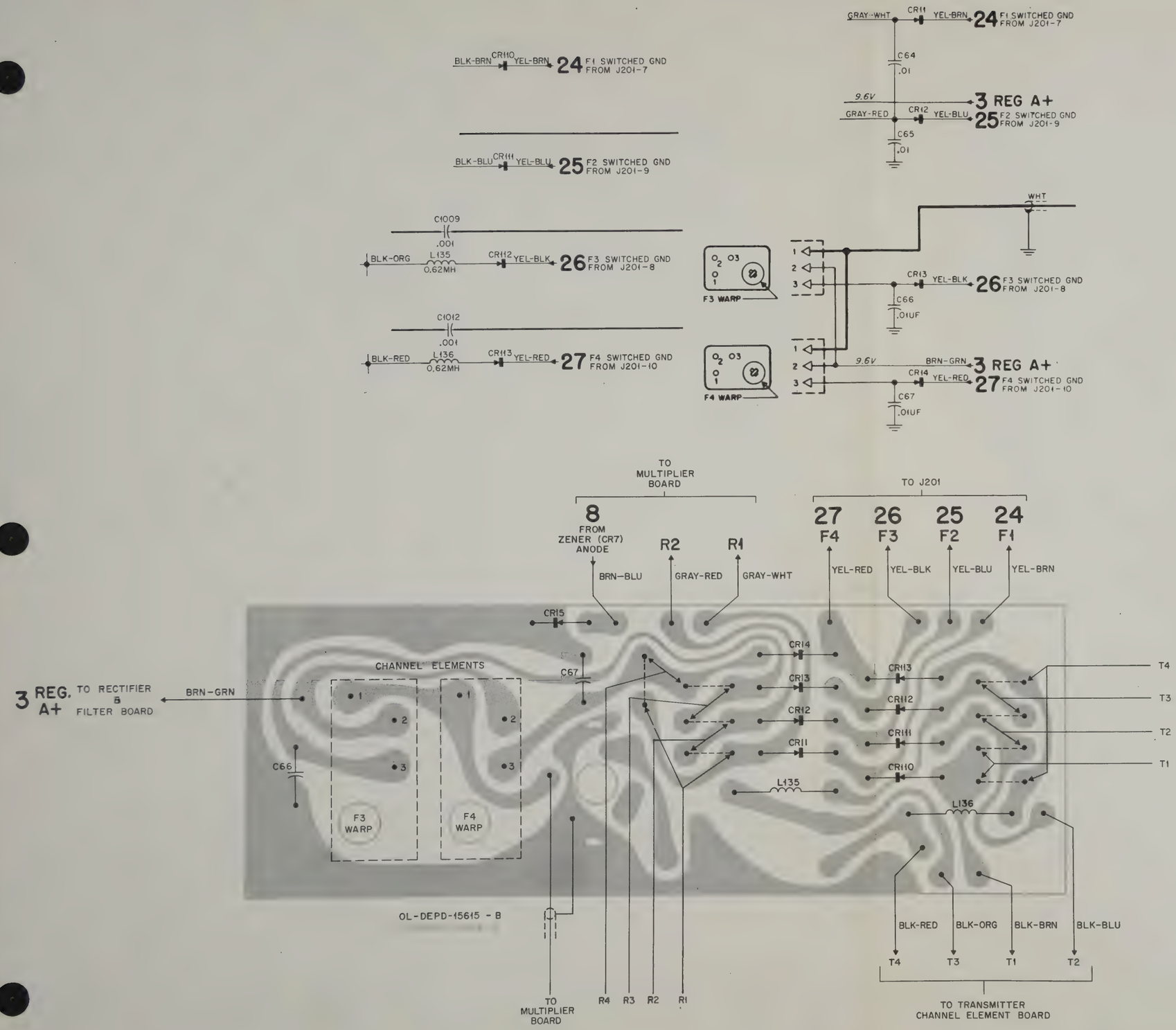
STEP	STAGE AND PROCEDURE
1	DISCRIMINATOR PRIMARY -- Set up the test set as described in paragraph B at the left. Insert a 2 uuf capacitor in series with the r-f probe. Place the r-f probe on the input to the 455 kc i-f filter (POINT 1). Adjust L12 so that the slug is very close to the top of the coil. Adjust T5 for a maximum indication on the test set meter in position 5. Use screwdriver end of tuning tool B.
2	DISCRIMINATOR SECONDARY -- Use the "0" center scale on the test set. Adjust L12 for absolute zero on the "0" center (top) scale with the switch in position 4. Use screwdriver end of tuning tool B. This is a critical adjustment and should be exactly on zero. Remove the r-f probe.
3	8 MC IF -- Set up the test equipment as described in paragraph C at the left of this page. Use the minimum 8 mc signal that will produce a linear increase in test set meter reading with an increase in signal strength (selector switch in position 1). Tune L10, L9, T2, T1, and L8 in that order, for a maximum test set meter indication with the selector switch in position 1. Use the wide screwdriver end of tuning tool C. Replace the first oscillator after channel element(s) after alignment is completed.
4	FIRST OSCILLATOR -- Uncouple the signal generator. Adjust coils L13 and L14 for maximum meter indication in position 6. Use hex end of tuning tool A. On multiple frequency receivers, set the frequency selector switch to the F3 or F4 position and adjust coil L18 for maximum meter indication in position 6.
5	ON-FREQUENCY ADJUSTMENT -- Transmit a carrier from the transmitter which this receiver is normally intended to receive. If the "Motrac" transmitter and receiver are on the same frequency and if the transmitter is known to be "on-frequency" connect the antenna to the radio set antenna connector, and short the KEY contact located on the exciter board. This allows the transmitter to be heard in the receiver and an external transmitter is not required. Listen for quieting of noise at the test set speaker. Test set position 1 should indicate a rise when the transmitter is "on". Check the meter indication in position 4; zero indicates "on-frequency". Set F1 "warp" capacitor for exact "0" center meter indication. On multiple frequency receivers, adjust F2, F3, and F4 "warp" capacitors for the corresponding frequency.
6	MULTIPLIER -- Set up the signal generator as described in paragraph D at the left. Apply as much signal as is necessary for a small indication in meter position 1. Align coil L15 (use hex end of tuning tool A) and coils L16, L17 (use screwdriver end of tuning tool C) for maximum in position 1.
7	RF DECK -- Set up the signal generator as described in paragraph D at the left. Apply as much signal as is necessary for a small indication in meter position 1. If no indication can be obtained in meter position 1, adjust slugs L1 through L6 flush with the top of the r-f casting and turn slug L7 three turns from the bottom. Use screwdriver end of tuning tool C. Tune L1 through L6 clockwise 1/2 turn until a reading in meter position 1 is obtained. Tune L1, L2, L3, L4, L5, L6 and L7, in that order, for maximum in meter position 1. Reduce generator output as required. Continue the above procedure until all slugs are tuned for maximum in meter position 1. Turn L1 through L6 counterclockwise 1/4 turn. Set the signal generator output for a reading of about 15 ua on position 1 and repeak twice L1 through L7, in that order, for maximum in meter position 1.

I. AVERAGE STAGE MEASUREMENTS WITH THE RADIO SET PROPERLY ADJUSTED

APPROXIMATE MICROVOLT INPUT	INPUT TO		FREQUENCY	METER POSITION	TEST SET METER READING
No Signal	Antenna Disconnected			1	2.0 ua
No Signal	Antenna Disconnected			2	20 ua
No Signal	Antenna Disconnected			4	0
No Signal	Antenna Disconnected			5	15 ua
No Signal	Antenna Disconnected			6	10 ua
0.5	Antenna Connector		Carrier Freq.		20 DB Quieting
0.6	Antenna Connector		Carrier Freq.	1	15 ua
0.5	Base	1st Mixer (Q2)	Carrier Freq.		20 DB Quieting
140	Collector		8 mc	1	15 ua
12.5	Base	8 mc IF Transistor (Q3)	8 mc	1	15 ua
180	Collector				
8.0	Base	2nd Mixer (Q4)	8 mc	1	15 ua
250	Collector		0.455 mc	1	15 ua
110	Base	455 kc Ampl. Transistor (Q5) in 455 kc filter	0.455 mc	1	15 ua
2200	Collector				
1600	Base	1st 455 kc IF Transistor (Q6)	0.455 mc	1	15 ua
60000	Collector				

STAGE MEASUREMENT NOTES

1. All measurements made with signal generator tuned to the required frequency.
2. All measurements, except antenna input, taken with 50 ohm terminated cable with a 0.003 uf capacitor in series.
3. First mixer quieting is measured with the r-f coax input lead to the 8 mc i-f strip disconnected.



BASIC JUMPER CONNECTIONS FOR FOUR-FREQUENCY RADIO SETS

NO. OF FREQS.		JUMPERS				JUMPERS				RCVR CHAN ELEMENT LOCATION				XMTR CHAN ELEMENT LOCATION			
XMIT	RCV	R1	R2	R3	R4	T1	T2	T3	T4	1	2	3	4	1	2	3	4
1	4	○	○	○	○	●	●	●	●	X	X	X	X	X			
2	4	○	○	○	○	○	●	●	●	X	X	X	X	X	X		
3	4	○	○	○	○	○	○	●	●	X	X	X	X	X	X	X	
4	4	○	○	○	○	○	○	○	●	X	X	X	X	X	X	X	X
1	3	○	○	○		●	●	●		X	X	X		X			
2	3	○	○	○		○	●	●		X	X	X		X	X		
3	3	○	○	○		○	○	●		X	X	X		X	X	X	
4	3	○	○	○		○	○	○		X	X	X		X	X	X	X
1	2	○	○			●	●			X	X			X			
2	2	○	○			○	●			X	X			X	X		
3	2	○	○			○	○			X	X			X	X	X	
4	2	○	○			○	○			X	X			X	X	X	X
1	1	○				●				X				X			
2	1	○				○	●			X				X	X		
3	1	○				○	○	●		X				X	X	X	
4	1	○				○	○	○		X				X	X	X	X

NOTE:

R1, R2, R3, R4, T1, T2, T3 AND T4 ARE THE LOCATIONS OF JUMPER POINTS. DASHED LINES ON THE DIAGRAM INDICATE THEIR RECOMMENDED JUMPER PATHS, WHEN LESS THAN FOUR FREQUENCIES ARE USED.

CAUTION

WHEN ADDING CHANNEL ELEMENTS, JUMPERS MUST BE REMOVED. REMOVE JUMPERS FROM BOARD AT THE JUMPER POINTS SHOWN IN THE TABLE WHEN CHANGING TYPE OF OPERATION.

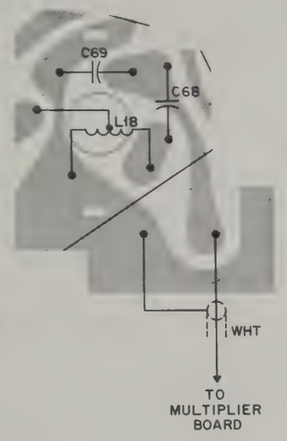
EPD-15380-C

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

F3 & F4 Receiver Circuit Board Detail
Model TLN8324A, 406-420 & 450-470 MC
4-Frequency "Motrac" Radio Set
Motorola No. EPD-15616-D (T-2502M)
3/6/67-UP

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TLN8324A-1	CR11, 12, 13, 14, 110, 111, 112, 113	WERE 48C82392B05 OR 48C82392B07	PARTS LIST
B			DOTTED JUMPERS ADDED TO JUMPER TABLE	
C	TLN8324A-2	L18	REMOVED: WAS 24V80905A64	PARTS LIST
		C68	REMOVED; WAS 21D82610C03 47 uuf ±5%; 200 V; N220	
		C69	REMOVED; WAS 21K865446 100 uuf ±3%; 500 V	
		NON-REF	REMOVED; WAS 26A82076C01 SHIELD	
			CIRCUIT WAS AS SHOWN BELOW	
D			KEYING NUMBERS REVISED.	



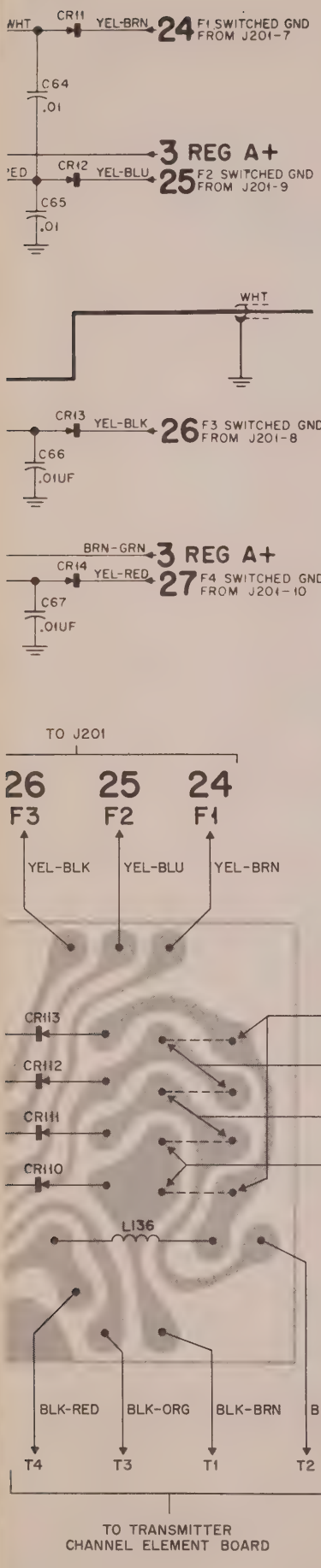
PARTS LIST

TLN8324A F3 & F4 Receiver Board EPD-14201-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C66, 67	21C82428B59	.01 uf +80-20%; 200 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR11, 12, 13, 14, 110, 111, 112, 113	48C82392B03	silicon
CR15	48C82392B05 or48C82392B07	silicon silicon
		COIL, RF:
L135, 136	24V80900A61	choke; 0.62 mh

NOTE:

Replacement diodes must be ordered by Motorola part number only for optimum performance.



BASIC JUMPER CONNECTIONS FOR FOUR-FREQUENCY RADIO SETS

NO. OF FREQS.		JUMPERS				JUMPERS				RCVR CHAN ELEMENT LOCATION				XMTR CHAN ELEMENT LOCATION			
XMIT	RCV	R1	R2	R3	R4	T1	T2	T3	T4	1	2	3	4	1	2	3	4
1	4	○	○	○	○	●	●	●	●	X	X	X	X	X			
2	4	○	○	○	○	○	●	●	●	X	X	X	X	X	X		
3	4	○	○	○	○	○	○	●	●	X	X	X	X	X	X	X	
4	4	○	○	○	○	○	○	○	○	X	X	X	X	X	X	X	X
1	3	○	○	●	●	●	●	●	●	X	X	X		X			
2	3	○	○	●	●	○	●	●	●	X	X	X		X	X		
3	3	○	○	●	●	○	○	●	●	X	X	X		X	X	X	
4	3	○	○	●	●	○	○	○	○	X	X	X		X	X	X	X
1	2	○	●	●	●	●	●	●	●	X	X			X			
2	2	○	●	●	●	○	●	●	●	X	X			X	X		
3	2	○	●	●	●	○	○	●	●	X	X			X	X	X	
4	2	○	●	●	●	○	○	○	○	X	X			X	X	X	X
1	1	●	●	●	●	●	●	●	●	X				X			
2	1	●	●	●	●	○	●	●	●	X				X	X		
3	1	●	●	●	●	○	○	●	●	X				X	X	X	
4	1	●	●	●	●	○	○	○	○	X				X	X	X	X

NOTE:

R1, R2, R3, R4, T1, T2, T3 AND T4 ARE THE LOCATIONS OF JUMPER POINTS. DASHED LINES ON THE DIAGRAM INDICATE THEIR RECOMMENDED JUMPER PATHS, WHEN LESS THAN FOUR FREQUENCIES ARE USED.

CAUTION

WHEN ADDING CHANNEL ELEMENTS, JUMPERS MUST BE REMOVED. REMOVE JUMPERS FROM BOARD AT THE JUMPER POINTS SHOWN IN THE TABLE WHEN CHANGING TYPE OF OPERATION.

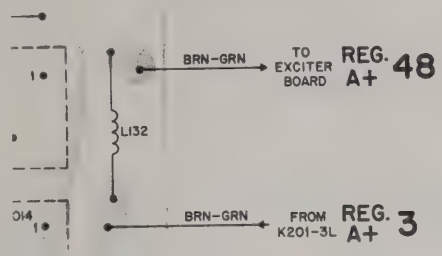
EPD-15380-C

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

F3 & F4 Receiver Circuit Board Detail
Model TLN8324A, 406-420 & 450-470 MC
4-Frequency "Motrac" Radio Set
Motorola No. EPD-15616-D (T-2502M)
3/6/67-UP

REVISIONS

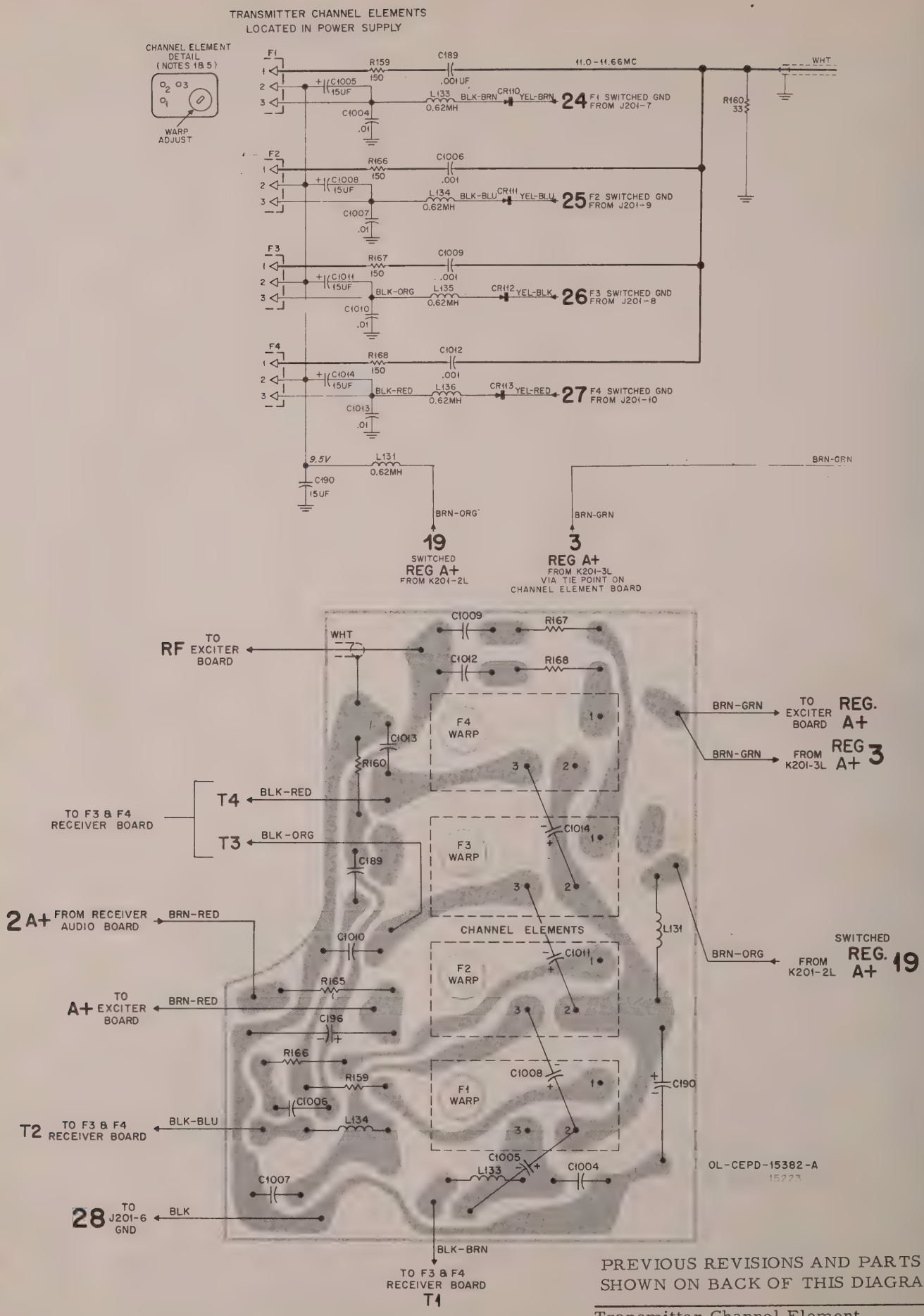
DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TLN8530A	C190, 196	ADDED 15 uf	PARTS LIST
B	TLN8530A-1	L132	REMOVED 24V80900A61 0.62 MH CIRCUIT WAS AS SHOWN BELOW:	TOP RIGHT OF CKT. BD.



PARTS LIST

TLN8530A Xmtr. Channel Element Board
(Multiple Frequency) EPD-15556-1

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C189, 1006, 1009, 1012	21C82187B20	.001 uf ±10%; 100 v
C190, 196, 1005, 1008, 1011, 1014	23K865136	15 uf ±20%; 25 v
C1004, 1007 1010, 1013	21D82428B59	.01 uf +80-20%; 200 v
		COIL, RF:
L131, 133, 134	24V80900A61	choke; 0.62 mh; sleeved
		RESISTOR, fixed: ±10%;
R159, 166, 167, 168	6S129862	150; 1/4 w
R160	6S129754	33; 1/4 w
R165	6S6406	22; 1/2 w



PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Transmitter Channel Element
Circuit Board Detail, Model TLN8530A-1
406-420 & 450-470 MC
Multi-Frequency "Motrac" Radio Sets
Motorola No. EPD-15381-B (MR-2135B)
3/6/67-UP

MOTRAC®

MOBILE FM TWO-WAY RADIO

406-420 & 450-470 MC 20, 40 & 60 W RF POWER

± 12 VOLT SYSTEMS

68P81040A05-D

MOTOROLA

MOTRAC

MOBILE FM TWO-WAY RADIO

406-420 MC & 450-470 MC

20, 40 AND 60 W

±12 VOLT SYSTEMS

MOTOROLA INC. Communications Division

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10/4/68-GM

68P81040A05
Issue - D

SPECIFICATIONS

GENERAL

MAXIMUM BATTERY DRAIN*	Standby: 13.8 v d-c (transmitter filaments off)	0.425 amp.
	Receive: 13.8 v d-c (transmitter filaments on)	3 amp.
	Transmit: 13.4 v d-c	20 amp. (20 w models), 23 amp. (40 w models) and 30 amp (60 w models)
*Drain figures for negative ground only, add 0.14 amp for positive ground operation.		
FREQUENCY RANGE		406-420 & 450-470 mc
METERING		A single scale, 0-50 microampere meter with 20,000 ohms equivalent series resistance or Motorola portable test set can be used to measure all circuits essential to tuning and checking.
DIMENSIONS		Dash Mount: 4" high x 13-3/8" wide x 19-1/2" long overall Trunk Mount: 3-1/4" high x 13-3/8" wide x 18-1/4" long overall
WEIGHT		approximately 30 lbs. (shipping weight including accessories: approximately 51 lbs.)

"L" RECEIVER

CHASSIS		TRE1110AA, AE	TRE1110AB, AD, AF, AH
CHANNEL SPACING		50 kc	25 kc
SELECTIVITY	-20 DB QUIETING	-100 db at ±30 kc	-100 db at ±17 kc
	-EIA SINAD	-85 db at ±50 kc	-85 db at ±25 kc
EIA SINAD INTERMODULATION		-65 db	
EIA MODULATION ACCEPTANCE		±16 kc minimum	±7 kc minimum
SENSITIVITY	-20 DB QUIETING	0.50 microvolt	
	EIA SINAD	0.35 microvolt	
FREQUENCY STABILITY		Channel element maintains oscillator frequency within ±.0005% (±0.0002% with optional TLN1086A Channel Element) of reference frequency from -30°C to +60°C ambient (+25°C reference) and ±0.00015% with a 15% primary voltage deviation.	
SPURIOUS & IMAGE REJECTION		more than 100 db	
SQUELCH		Carrier Squelch; noise compensated type, adjustable sensitivity; threshold sensitivity of 0.25 microvolt or less (Patent No. 2343115 other patents pending). "Private-Line" Tone-Coded Squelch; also includes a tone-operated squelch circuit with a fixed sensitivity of 0.25 microvolt or less (Patent No. 2688059).	
AUDIO OUTPUT		5 watts to a 3 ohm load measured at the receiver output at less than 5% distortion.	
AUDIO RESPONSE		+1, -8 db of 6 db/octave de-emphasis characteristic from 300 to 3000 cps	

"H" TRANSMITTER

CHASSIS	TTE1060AA
RF POWER OUTPUT	20, 40 & 60 watts
OUTPUT IMPEDANCE	50 ohms
SPURIOUS & HARMONIC EMISSION	Spurious emission more than 90db below carrier. Harmonic emission more than 80 db below carrier. (Per EIA spec, RS152A, par.3)
FREQUENCY STABILITY	Channel element maintains oscillator frequency within ±0.0005% (±0.0002% with optional TLN1087A Channel Element) of reference frequency from -30°C to +60°C ambient (+25°C ref) and ±0.00015% with 15% primary voltage deviation.
MODULATION	36F3: ±15 kc for 100% at 1000 cps or 16F3: ±5 kc for 100% at 1000 cps
AUDIO SENSITIVITY	0.165 volt ±3 db for 2/3 max. deviation at 1000 cps
FM NOISE	-60 db below 2/3 system deviation at 1000 cps
AUDIO RESPONSE	+1, -3 db of 6 db/octave pre-emphasis characteristic from 300 to 3000 cps.
AUDIO DISTORTION	Less than 3% at 1000 cps; 2/3 system deviation

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

FCC LICENSE DESIGNATION:

CC4018 for 60 W (indicates transmitter using ±.0005% frequency stability channel element)
CC4018C for 60 W (indicates transmitter using ±.0002% frequency stability channel element)
CC4024 for 40 W (indicates transmitter using ±.0005% frequency stability channel element)
CC4024C for 40 W (indicates transmitter using ±.0002% frequency stability channel element)
CC4019 for 20 W (indicates transmitter using ±.0005% frequency stability channel element)
CC4019C for 20 W (indicates transmitter using ±.0002% frequency stability channel element)

FOREWORD

SCOPE OF INSTRUCTION MANUAL

This manual offers descriptive and service information for the radio sets described in it. Service diagrams, parts lists, and printed circuit board details are also part of the instruction packet.

NOMENCLATURE

The equipment described in this manual is packaged as a radio set plus accessories. The radio set is specifically identified by the model number on the nameplate.

NOTE

Be sure to use the entire model number when making inquiries about your equipment.

The accessories are identified by an accessory group number which includes the other items essential to completing the radio installation such as: antenna, cables, etc. Use this number when referring to a specific group of accessories.

Identifiers have been assigned to chassis and kits. Use these identifiers when requesting information or ordering replacements.

Radio set and accessory group charts are located in the front of this manual.

PRODUCTION CHANGES

When production and engineering changes are incorporated into the equipment, a revision numeral is assigned to the chassis or kit affected.

Typical Example:
A Model TTD1251AA Transmitter becomes TTD1251AA-1 with the first revision.

This chassis number complete with revision numeral if any, is stamped on the chassis at the time of production. The revision numeral becomes an integral part of the chassis identifier.

A schematic diagram number complete with its issue letter is also stamped on each chassis. This establishes direct correlation between the chassis and its schematic. The schematic issue is advanced each time a change occurs in the chassis.

INSTRUCTION MANUAL REVISIONS

Changes which occur after an instruction manual is printed are described in the Instruction Manual Revisions. These bulletins give the reader complete information on the change including pertinent parts listing data.

NATIONAL SERVICE ORGANIZATION

Motorola provides a nation-wide service organization. Through its maintenance and installation program Motorola makes available the finest service to those desiring reliable continuous communications on a contract basis.

The largest service organization specializing in mobile communications is Motorola's National Service Organization. Over 800 strategically located, adequately staffed and trained, independently owned and operated stations, manned with several thousand FCC licensed personnel constitute the sub-contracting force.

The administrative forces of area and district service managers and district service representatives are in the direct employ of Motorola.

For your contract service requirements, please contact your local Motorola representative or write to:

National Service Manager
Motorola Communications Division
4501 W. Augusta Blvd., Chicago, Illinois 60651

REPLACEMENT PARTS ORDERING

Motorola maintains parts and service depots and autorized service stations strategically located throughout the country. These facilities are fully equipped to give the finest service.

When ordering replacement parts, the complete number identification of the item must be used whether it be a component, kit or complete chassis. This will fix proper identification and insure receipt of the desired item. Complete number identification should also be used when requesting equipment information

68P81009A98-H

Channel element orders should specify channel element type number, crystal frequency, carrier frequency and the chassis model number in which the channel element is to be used.

Orders for "Vibrasender" and "Vibrasponder" resonant reeds should specify the type number and frequency and should identify the owner and operator of the communications system in which these items are to be used.

CAREFUL USE OF THE INSTRUCTION MANUAL AND THE MANY SUGGESTIONS CONTAINED IN IT WILL FURTHER INSURE PROPERLY INSTALLED AND MAINTAINED RADIO EQUIPMENT.

THE EQUIPMENT DESCRIBED IN THIS MANUAL IS MANUFACTURED UNDER ONE OR MORE OF THE FOLLOWING MOTOROLA U.S. PATENTS:

RE-24, 110	2, 738, 466	2, 925, 562	3, 083, 332	3, 200, 337	3, 281, 697
RE-24, 815	2, 740, 891	2, 938, 082	3, 087, 117	3, 204, 202	3, 284, 714
RE-26, 079	2, 743, 361	2, 963, 577	3, 087, 998	3, 205, 455	3, 298, 098
2, 524, 534	2, 759, 052	2, 966, 585	3, 087, 999	3, 217, 270	3, 292, 085
2, 547, 023	2, 759, 103	2, 974, 221	3, 091, 736	3, 218, 587	3, 293, 644
2, 547, 025	2, 777, 950	2, 984, 740	3, 094, 293	3, 221, 120	3, 295, 060
2, 547, 027	2, 799, 010	2, 994, 844	3, 101, 441	3, 223, 953	3, 300, 723
2, 583, 032	2, 808, 507	3, 009, 115	3, 119, 093	3, 233, 243	3, 304, 501
2, 608, 648	2, 809, 236	3, 014, 127	3, 126, 514	3, 234, 469	3, 304, 503
2, 608, 649	2, 830, 200	3, 027, 454	3, 128, 431	3, 234, 484	3, 305, 779
2, 626, 384	2, 833, 994	3, 027, 455	3, 129, 396	3, 247, 475	3, 306, 990
2, 637, 782	2, 883, 521	3, 039, 081	3, 131, 354	3, 250, 997	3, 307, 051
2, 650, 333	2, 834, 879	3, 041, 550	3, 149, 317	3, 250, 999	3, 307, 121
2, 688, 059	2, 888, 652	3, 048, 659	3, 162, 821	3, 252, 109	3, 322, 982
2, 691, 094	2, 899, 547	3, 048, 747	3, 175, 183	3, 256, 497	3, 333, 122
2, 691, 560	2, 901, 601	3, 059, 184	3, 175, 187	3, 263, 172	
2, 699, 425	2, 912, 573	3, 061, 785	3, 175, 193	3, 264, 576	
2, 705, 281	2, 918, 571	3, 070, 737	3, 183, 382	3, 273, 083	
2, 731, 555	2, 924, 705	3, 070, 748	3, 191, 123	3, 275, 938	

Other U.S. Patents Pending

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IMPORTANT

The complete instruction manual for this equipment consists of (1) text material and (2) diagrams supplied as a packet. The packet is identified by radio set description and part number. This identifying information appears in the packet front window. The model number and corresponding packet number are listed in the model chart in this manual.

MOTOROLA

MODEL CHART

FOR

406-420 & 450-470 MC

"MOTRAC"

FM TWO-WAY MOBILE RADIO SETS

CODE:

[X] = ONE ITEM SUPPLIED

[/] - ONE ITEM SUPPLIED WITH EACH ORDER OF FIVE RADIO SETS OR LESS.

[2] - NUMBER OF ITEMS SUPPLIED.

*REPRESENTS A SERIES OF MODELS AND NOT A SPECIFIC MODEL. THE SPECIFIC MODEL, AS STAMPED ON THE CHASSIS, IS DETERMINED BY ITS APPLICATION.

MODEL	XMTR RF POWER (IN W)	CHANNEL SPACING	RCVR. FREQS.	XMTR. FREQS.	ACCESSORY GROUP	PACKET
CARRIER SQUELCH (450-470 MC)						
U44LHT-1000A	20	50 KC	1	1	FF OR FG (1100 SERIES)	68P81038A90
U44LHT-1100A	20	25 KC	1	1	FF OR FG (1100 SERIES)	68P81038A90
U54LHT-1000A	40	50 KC	1	1	FF OR FG (1100 SERIES)	68P81038A90
U54LHT-1100A	40	25 KC	1	1	FF OR FG (1100 SERIES)	68P81038A90
U64LHT-1000A	60	50 KC	1	1	FF OR FG (1100 SERIES)	68P81038A90
U64LHT-1100A	60	25 KC	1	1	FF OR FG (1100 SERIES)	68P81038A90
"PRIVATE-LINE" TONE-CODED SQUELCH (450-470 MC)						
U44LHT-3000A	20	50 KC	1	1	FF OR FG (3100 SERIES)	68P81038A90
U44LHT-3090A	20	50 KC	4	4	FG (1100 SERIES)	68P81043A65
U44LHT-3100A	20	25 KC	1	1	FF OR FG (3100 SERIES)	68P81038A90
U44LHT-3190A	20	25 KC	4	4	FG (1100 SERIES)	68P81043A65
U54LHT-3000A	40	50 KC	1	1	FF OR FG (3100 SERIES)	68P81038A90
U54LHT-3090A	40	50 KC	4	4	FG (1100 SERIES)	68P81043A65
U54LHT-3100A	40	25 KC	1	1	FF OR FG (3100 SERIES)	68P81038A90
U54LHT-3190A	40	25 KC	4	4	FG (1100 SERIES)	68P81043A65
U64LHT-3000A	60	50 KC	1	1	FF OR FG (3100 SERIES)	68P81038A90
U64LHT-3090A	60	50 KC	4	4	FG (1100 SERIES)	68P81043A65
U64LHT-3100A	60	25 KC	1	1	FF OR FG (3100 SERIES)	68P81038A90
U64LHT-3190A	60	25 KC	4	4	FG (1100 SERIES)	68P81043A65
CARRIER SQUELCH (406-420 & 450-470 MC)						
U44LHT-1090A	20	50 KC	4	4	FG (1100 SERIES)	68P81043A65
U44LHT-1190A	20	25 KC	4	4	FG (1100 SERIES)	68P81043A65
U54LHT-1090A	40	50 KC	4	4	FG (1100 SERIES)	68P81043A65
U54LHT-1190A	40	25 KC	4	4	FG (1100 SERIES)	68P81043A65
U64LHT-1090A	60	50 KC	4	4	FG (1100 SERIES)	68P81043A65
U64LHT-1190A	60	25 KC	4	4	FG (1100 SERIES)	68P81043A65

ITEM	DESCRIPTION
*TRE1110AA	RECEIVER, 1-FREQ. CARRIER SQUELCH
*TRE1110AB	RECEIVER, 1-FREQ. CARRIER SQUELCH
*TRE1110AC	RECEIVER, 4-FREQ. CARRIER SQUELCH
*TRE1110AD	RECEIVER, 4-FREQ. CARRIER SQUELCH
*TRE1110AE	RECEIVER, 1-FREQ. "PRIVATE-LINE" TONE-CODED SQUELCH
*TRE1110AF	RECEIVER, 1-FREQ. "PRIVATE-LINE" TONE-CODED SQUELCH
*TRE1110AG	RECEIVER, 4-FREQ. "PRIVATE-LINE" TONE-CODED SQUELCH
*TRE1110AH	RECEIVER, 4-FREQ. "PRIVATE-LINE" TONE-CODED SQUELCH
*TTE1060AA	TRANSMITTER
TPN1048AA	POWER SUPPLY
TPN1048AC	POWER SUPPLY WITH "PRIVATE-LINE" TONE OSCILLATOR
TGN6002A	FRONT PANEL
TLN8437A	TRANSMITTER CHANNEL ELEMENT BOARD, 1-FREQ.
TLN8530A	TRANSMITTER CHANNEL ELEMENT BOARD, 4-FREQ.
TKN6314A	INTERCABLE KIT
TKN6315A	INTERCABLE KIT, 4-FREQ.
THN6002A	HOUSING KIT
TLN8284A	UNIT HARDWARE KIT
TLN6832A	NEGATIVE GROUND KIT
TLN6190A	FUSE KIT
TLN1095A	OSCILLATOR KIT, 4-FREQ.
TLN1081A	CHANNEL ELEMENT, RECEIVER
TLN1083A	CHANNEL ELEMENT, TRANSMITTER
TLN6845A	TUNING TOOLS
TLN6824AA	"VIBRASENDER" RESONANT REED
TLN8381A	"VIBRASPONDER" RESONANT REED

EPD-15176-E

MOTOROLA

406-420 MC AND 450-470 MC 20, 40 AND 60 WATT RF POWER

"MOTRAC"

FM TWO-WAY MOBILE PACKAGE RADIO SET MODELS

WITH TRUNK-MOUNT ACCESSORIES

CODE:

☒ = ONE ITEM SUPPLIED
* = SEE BASIC RADIO SET MODEL CHART FOR RADIO SET COMPLEMENT

⊠ = ONE SUPPLIED DEPENDENT ON FREQUENCY RANGE

PACKAGE MODEL	INCLUDES* BASIC UNIT	XMTR. RF POWER	NO. OF RCVR. FREQ.	NO. OF XMTR. FREQ.	CHANNEL SPACING	ACCESSORY ITEMS: MODEL	DESCRIPTION
		CARRIER SQUELCH (450-470 MC)					
T44LHT-1000AK	U44LHT-1000A	20	1	1	50 KC	TCN6098BE	CONTROL HEAD WITH DIMMER, 1-FREQ., CARRIER SQUELCH
T44LHT-1100AK	U44LHT-1100A	20	1	1	25 KC	TCN6098BG	CONTROL HEAD WITH DIMMER, 1-FREQ., "PRIVATE-LINE"
T54LHT-1000AK	U54LHT-1000A	40	1	1	50 KC	TCN6098BJ	CONTROL HEAD WITH DIMMER, 4-FREQ., CARRIER SQUELCH
T54LHT-1100AK	U54LHT-1100A	40	1	1	25 KC	TCN6098BK	CONTROL HEAD WITH DIMMER, 4-FREQ., "PRIVATE-LINE"
T64LHT-1000AK	U64LHT-1000A	60	1	1	50 KC	TKN6059A	CABLE KIT, 1-FREQ.
T64LHT-1100AK	U64LHT-1100A	60	1	1	25 KC	TKN6060A	CABLE KIT, 2-FREQ.
		"PRIVATE-LINE" TONE-CODED SQUELCH (450-470 MC)				TSN6000A	SPEAKER
T44LHT-3000AK	U44LHT-3000A	20	1	1	50 KC	TMN6013A	MICROPHONE
T44LHT-3090AK	T44LHT-3090A	20	4	4	50 KC	TAE6071A	ANTENNA, 406-420 MC
T44LHT-3100AK	U44LHT-3100A	20	1	1	25 KC	TAE6072A	ANTENNA, 450-470 MC
T44LHT-3190AK	T44LHT-3190A	20	4	4	25 KC	TIN6042A	INSTALLATION KIT
T54LHT-3000AK	U54LHT-3000A	40	1	1	50 KC		
T54LHT-3090AK	T54LHT-3090A	40	4	4	50 KC		
T54LHT-3100AK	U54LHT-3100A	40	1	1	25 KC		
T54LHT-3190AK	T54LHT-3190A	40	4	4	25 KC		
T64LHT-3000AK	U64LHT-3000A	60	1	1	50 KC		
T64LHT-3090AK	T64LHT-3090A	60	4	4	50 KC		
T64LHT-3100AK	U64LHT-3100A	60	1	1	25 KC		
T64LHT-3190AK	T64LHT-3190A	60	4	4	25 KC		
		CARRIER SQUELCH (406-420 MC & 450-470 MC)					
T44LHT-1090AK	T44LHT-1090A	20	4	4	50 KC		
T44LHT-1190AK	T44LHT-1190A	20	4	4	25 KC		
T54LHT-1090AK	T54LHT-1090A	40	4	4	50 KC		
T54LHT-1190AK	T54LHT-1190A	40	4	4	25 KC		
T64LHT-1090AK	T64LHT-1090A	60	4	4	50 KC		
T64LHT-1190AK	T64LHT-1190A	60	4	4	25 KC		

EPS-721-B

MOTOROLA

ACCESSORY GROUP CHART

FOR

406-420 & 450-470 MC

"MOTRAC"

FM TWO-WAY MOBILE RADIO SETS

CODE:

☒ = ONE ITEM SUPPLIED

GROUP NUMBER	TYPE OF INSTALLATION	TYPE OF SQUELCH	NO. OF FREQS.	MICROPHONE INCLUDED	ANTENNA INCLUDED
FF1155AL	DASH MOUNT/DIMMER	CARRIER	1	YES	YES
FF3155AL	DASH MOUNT/DIMMER	"PL" TONE-CODED SQUELCH	1	YES	YES
FF1155B	DASH MOUNT	CARRIER	1	NO	YES
FF1155BM	DASH MOUNT	CARRIER	1	YES	YES
FF1157B	DASH MOUNT	CARRIER	1	NO	NO
FF3155B	DASH MOUNT	"PL" TONE-CODED SQUELCH	1	NO	YES
FF3155BM	DASH MOUNT	"PL" TONE-CODED SQUELCH	1	YES	YES
FF3157B	DASH MOUNT	"PL" TONE-CODED SQUELCH	1	NO	NO
FG1155A	TRUNK MOUNT	CARRIER	1	NO	YES
FG1155AL	TRUNK MOUNT/DIMMER	CARRIER	1	YES	YES
FG1155AM	TRUNK MOUNT	CARRIER	1	YES	YES
FG1157AM	TRUNK MOUNT	CARRIER	1	YES	NO
FG1195A	TRUNK MOUNT	CARRIER	4	NO	YES
FG1195AL	TRUNK MOUNT/DIMMER	CARRIER	4	YES	YES
FG1195AM	TRUNK MOUNT	CARRIER	4	YES	YES
FG3155A	TRUNK MOUNT	"PL" TONE-CODED SQUELCH	1	NO	YES
FG3155AL	TRUNK MOUNT/DIMMER	"PL" TONE-CODED SQUELCH	1	YES	YES
FG3155AM	TRUNK MOUNT	"PL" TONE-CODED SQUELCH	1	YES	YES
FG3157AM	TRUNK MOUNT	"PL" TONE-CODED SQUELCH	1	YES	NO
FG3195A	TRUNK MOUNT	"PL" TONE-CODED SQUELCH	4	NO	YES
FG3195AL	TRUNK MOUNT/DIMMER	"PL" TONE-CODED SQUELCH	4	YES	YES
FG3195AM	TRUNK MOUNT	"PL" TONE-CODED SQUELCH	4	YES	YES

ITEM	DESCRIPTION	TCN6026AE	TCN6026AJ	TCN6026AG	TCN6026AK	TCN6025AE	TCN6098AJ	TCN6025AG	TCN6098AK	TCN6098AE	TCN6097AG	TCN6098AG	TCN6097AE	TSN6000A	TMN6013A	TLN6042A	TLN6238A	TLN6190A	TU308	TKN6059A	TKN6060A
TCN6026AE	CONTROL HEAD, CARRIER SQUELCH, ONE-FREQUENCY												X	X	X	X	X	X			
TCN6026AJ	CONTROL HEAD, CARRIER SQUELCH, FOUR-FREQUENCY												X	X	X	X	X	X			
TCN6026AG	CONTROL HEAD, "PL" TONE-CODED SQUELCH, ONE-FREQUENCY													X		X	X	X	X		
TCN6026AK	CONTROL HEAD, "PL" TONE-CODED SQUELCH, FOUR-FREQUENCY													X	X	X	X	X	X		
TCN6025AE	CONTROL HEAD, CARRIER SQUELCH, ONE-FREQUENCY													X		X	X	X	X		
TCN6098AJ	CONTROL HEAD, CARRIER SQUELCH, FOUR-FREQUENCY													X		X	X	X	X		
TCN6025AG	CONTROL HEAD, "PL" TONE-CODED SQUELCH, ONE-FREQUENCY													X	X	X	X	X	X		
TCN6098AK	CONTROL HEAD, "PL" TONE-CODED SQUELCH, FOUR-FREQUENCY													X	X	X	X	X	X		
TCN6098AE	CONTROL HEAD, CARRIER SQUELCH, ONE-FREQUENCY													X		X	X	X	X		
TCN6097AG	CONTROL HEAD,"PL" TONE-CODED SQUELCH, ONE-FREQUENCY													X		X	X	X	X		
TCN6098AG	CONTROL HEAD, "PL" TONE-CODED SQUELCH, ONE-FREQUENCY																				
TCN6097AE	CONTROL HEAD, "PL" TONE-CODED SQUELCH, TWO-FREQUENCY																				
TSN6000A	SPEAKER																				
TMN6013A	MICROPHONE																				
TLN6042A	INSTALLATION KIT																				
TLN6238A	HOUSING MOUNTING BRACKET																				
TLN6190A	FUSE KIT																				
TU308	ANTENNA																				
TKN6059A	CABLE KIT (ONE-FREQUENCY)																				
TKN6060A	CABLE KIT (MULTI-FREQUENCY)																				

EPD-15177-B

DESCRIPTION

1. INTRODUCTION

The Motorola "Motrac" radio is a mobile FM two-way radio with a fully transistorized receiver, power supply, and exciter. Only the driver and final amplifier stages of the transmitter use tubes. The advantages of the transistor--low current requirements, reliability, light weight, compact size, and low maintenance requirements--are fully utilized. A wide variety of models are available with a 20, 40 or 60 watt transmitter r-f output, carrier squelch or "Private-Line" tone-coded squelch and multiple frequency operation. Refer to the Model Charts the front of this manual for a listing of the various models available.

2. PRIMARY POWER

The radio set can be used in either positive or negative ground 12-volt installations. For negative ground installations, a Model TLN6832A Negative Ground Kit is supplied. A Model TLN8482A Ground Reversing Kit (sold separately) permits operation in either positive or negative ground installations. The kit is a plug-in unit which provides the correct voltage polarities without the need for soldering or rewiring.

3. TRANSMITTERS

The 406-420 & 450-470 MC FM transmitters provide 20, 40 and 60 watts r-f output. Circuits include an unheated, temperature-compensated crystal oscillator module (channel element), transistorized audio amplifier and "IDC" (Instantaneous Deviation Control) circuit, varactor phase modulator, completely transistorized exciter (frequency multipliers and amplifiers), and tube-type driver and power amplifier stages. The output frequency is 36 times the crystal frequency. A high level of spurious frequency attenuation is achieved in a harmonic filter at the transmitter output.

4. RECEIVERS

The receivers used in these radio sets are crystal-controlled, dual-conversion models capable of five watts of audio power output. RF preselectors (tuned cavities) and a sealed, life-time guaranteed "Permakay" filter in the i-f stages determine the excellent bandwidth and selectivity characteristics. Plug-in crystal oscillator modules (channel elements) provide stable frequency control. The receiver also includes a noise actuated squelch circuit consisting of a noise limiter, a noise detector and a d-c control stage (switching circuit) to cutoff the audio amplifier. This eliminates disturbing noise when no messages are being received.

5. POWER SUPPLIES

The fully transistorized power supplies use long-life transistors in place of vibrator units. Vibrator replacement costs are eliminated and at the same time the overall radio set operation is improved. Silicon diode rectifiers are used to provide the greatest efficiency. All operating voltages for the transmitter are provided by the power supply. Heat sinks along the sides of the housing surround the power supply transistors.

6. "PRIVATE-LINE" TONE-CODED SQUELCH MODELS

Motorola "Private-Line" radios are especially useful when operating under crowded channel conditions. Several networks may share the same carrier frequency with a minimum of interference when each network uses a different "Private-Line" tone frequency.

In addition to freeing the operator from listening to messages not intended for him, the "Private-Line" tone-coded squelch circuit prevents noise bursts that occasionally get through a properly set carrier squelch receiver. Also, while a noise actuated squelch circuit can be improperly adjusted and thus reduce receiver sensitivity, a "Private-Line" squelch circuit always gives maximum sensitivity.

In a "Private-Line" system the transmitter output is modulated by a continuous sub-audible tone in addition to the voice modulation.

When the "PL" switch is ON, the receiver accepts only signals that are modulated by the same tone frequency as the transmitter and rejects all others. When the "PL" switch is OFF, a noise actuated squelch circuit is placed in parallel to allow other "on-frequency" signals to bypass the "Private-Line" tone-coded squelch.

7. BATTERY SAVER FEATURE

A unique feature of the "Motrac" radio set is the "battery saver" circuit. This circuit permits the power to be removed from the transmitter filaments and associated power supply when the radio set is used for receive operation only. The "battery saver" feature eliminates the need for special generators and engine idling to supply current for receiver operation thus greatly reducing gas consumption and vehicle maintenance costs. The battery power for the transmitter filaments and power supply keying is supplied through the vehicle ignition switch, while the power for the receiver is applied directly. Therefore, with the ignition switch "off" and the radio set "on", the battery is used for the receiver only.

Power consumption is minimized by the use of transistors in the receiver. Actual current drain during standby operation ("battery saver" in operation) is only 425 milliamperes (13.8 v d-c negative ground input). The low drain insures a longer battery life compared with a conventional higher drain radio set that uses vacuum tubes and is not equipped with the "battery saver" feature.

In radios using control heads without pilot light dimmers, the standby primary current drain can be reduced by approximately 200 ma. This is done by relocating the electrical connections to the green pilot lamp in the control head. Although not normally recommended, this may be done when extremely low primary current drain is required. Refer to the INSTALLATION AND OPERATION section of this manual for instructions.

8. KEYING AND NETTING FEATURES

A feature exclusive with "Motrac" radio equipment allows the transmitter to be keyed by simply shorting the KEY contact (located near the transmitter metering socket) to the exciter cover. This feature allows a simple method of keying the transmitter for alignment purposes. Before keying the transmitter, refer to the instructions in the transmitter alignment procedure. In addition, this contact provides a quick method of checking the frequency of either the transmitter or receiver if both are assigned to the same frequency and one is known to be "on-frequency". Shorting the contact causes the receiver, except the audio stages, and transmitter to function simultaneously. The discriminator output can be monitored from pin 4 of the receiver test socket.

9. HOUSING

The basic radio set consists of a transmitter, receiver and power supply assembled together to form a drawer unit which slides into the housing. All external connections are made through receptacles on the front panel.

The "Motrac" radio set uses heat sinks (radiators) to dissipate heat generated in the power supply and transmitter so that venting of the housing is unnecessary. This keeps the components free of dust, etc.

The radio set housing can be mounted either under the vehicle dashboard or in the trunk. The same drawer assembly, including transmitter, receiver and power supply, slides into the housing in either type of installation. In mobile radio fleets, where both dash and trunk-mount installations are used, this design provides full flexibility in exchanging radio sets between vehicles. Trunk-mounted radio sets are remotely controlled by means of a dash-mounted control head.

A chrome plated bar is attached to the front panel. When the bar is pulled up and outward, it becomes a carrying handle. A key lock is also mounted on the front panel to secure the drawer assembly from unauthorized persons.

For servicing purposes, the major chassis are easily accessible by removing the drawer unit from the housing. This provides access to all components in the radio set. Refer to the SERVICE AIDS section of this manual for instructions on the removal of individual components.

10. ACCESSORY GROUPS

In addition to the basic radio set, an accessory group is required to complete the installation. Various combinations of accessories are available to meet specific requirements. The accessory groups are listed in the Accessory Group Chart in the front part of this manual.

The control heads, available as part of the accessory groups, provide all the required control facilities for operation of the radio set. The dash-mount control heads connect directly into the front panel. Control heads for trunk-mounted

units, have an adjustable angle-bracket for mounting to the vehicle dash and are connected to the radio set via a cable kit.

Accessory groups are available with control heads using pilot light dimmers. This type of control head automatically increases or decreases the intensity of the transmit and receive pilot lights as the background illumination varies.

The microphone used with the radio set is a palm-type, dynamic microphone with a transistorized pre-amplifier. The microphone has a 12-inch tinsel-coiled cord and a 4 pin connector for plugging into the receptacle on the control head.

Special mounting brackets are included with all dash-mount accessory groups to mount the radio set in the passenger compartment of the vehicle. The brackets can be assembled in a number of different ways, thus providing various combinations of mounting angles and positions.

11. OPTIONAL ACCESSORIES

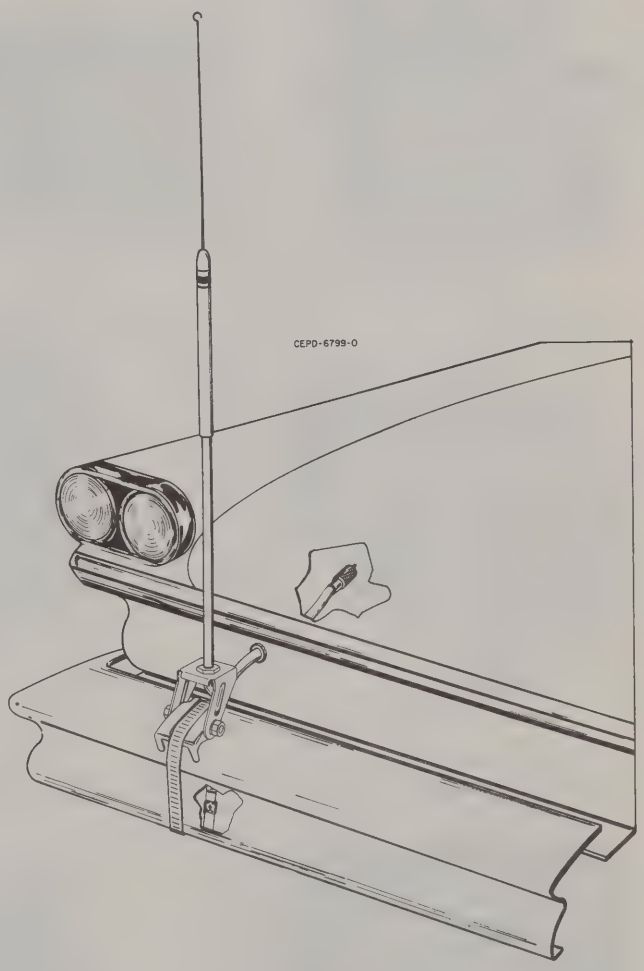
TMN6006B Dynamic Handset

The handset has a 4-pin connector for plugging directly into the control head receptacle.

The Model T1108A Time-Out Timer prevents extended transmission periods. An alert tone notifies the operator that the transmission time has elapsed and his transmitter has been disabled.

TLN6246A Hang-Up Switch Box
For "Private-Line" Tone-Coded Squelch Models

The switch box provides automatic switching to the carrier squelch circuit when the microphone is picked up.



TAE6010A and TAE6020A Bumper Mount Antennas

For use where a rooftop antenna is not practical or desirable. Both models are the same except that the mast of the TAE6020A is two feet longer for truck installations. Use the TLN6414A Mounting Kit for bumper mounting and The TLN6182A Mounting Kit for flat surface mounting such as the side of a truck cab or the body of a vehicle.

RECOMMENDED TEST EQUIPMENT

S1059A*
Portable Test Set

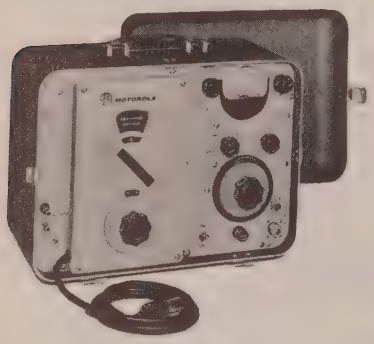
T1012A
Power Supply

T1013A
RF Load Resistor

DC Multimeter

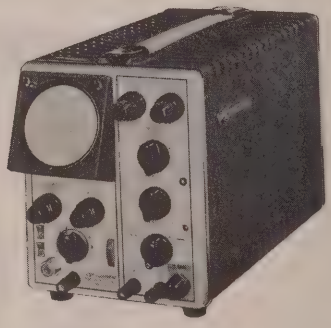
Transistorized AC
Voltmeter

TEK-1A
Transistorized Tone
Generator



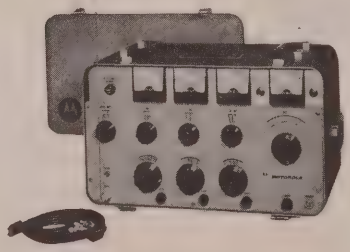
T1034C
Signal Generator

T1015A
General Purpose
Oscilloscope

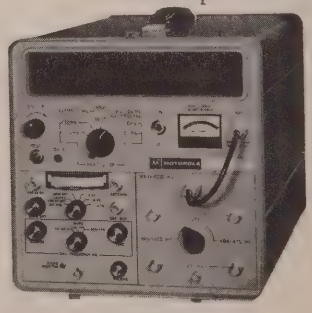


T1014B
Precision Wide Band
Oscilloscope

T1130A Series
FM Station Monitor



T1021B
Portable Frequency Meter



S1075B
Frequency Meter

*For use with "Motrac" radio sets, order TKN6025A Adapter Cable.

INSTALLATION AND OPERATION

1. INSTALLING THE RADIO SET

Complete installation instructions are packed in the shipping carton with the radio set. Install the radio set according to the instructions supplied.

CAUTION

This radio set, when supplied with a Model TLN6832A Negative Ground Kit, must be used in negative ground installations only. For positive ground installations, a Model TLN8482A Ground Reversing Kit is available. This kit must be inserted in the socket with the POS GND mark opposite the arrow on the power transformer when used in positive ground installations. The ground reversing kit may be used in negative ground installations also. In such cases, the kit must be inserted in the socket with the NEG GND mark opposite the arrow on the power transformer case.

2. OPERATING INSTRUCTIONS

TO RECEIVE

MULTI-FREQ. MODELS ONLY	Place the frequency selector switch in the desired position.
ALL MODELS	Place the ON-OFF switch in the ON position or turn the OFF-VOLUME control clockwise. The green lamp will go on to indicate the "standby" condition. The receiver is in full operation.

TO HEAR ALL ON-FREQUENCY SIGNALS

"PRIVATE-LINE" TONE-CODED SQUELCH MODELS ONLY	Place the "PL" ON-OFF switch in the OFF position.
ALL MODELS	Turn the SQUELCH control to the full counterclockwise position. Turn the VOLUME control clockwise until noise is heard. Adjust the SQUELCH control by turning it slowly clockwise until the noise is just squelched (cuts out). Set the VOLUME control to the desired listening level with a received signal.

TO HEAR ALL ON-FREQUENCY SIGNALS (CONTINUED)

ALL MODELS	control by turning it slowly clockwise until the noise is just squelched (cuts out). Set the VOLUME control to the desired listening level with a received signal.

TO HEAR "PRIVATE-LINE" SIGNALS ONLY

"PRIVATE-LINE" TONE-CODED SQUELCH MODELS	Place the "PL" ON-OFF switch in the ON position. Set the VOLUME control to the desired listening level with a received signal.

TO TRANSMIT

ALL MODELS	Proceed as previously described under "TO RECEIVE" and "TO HEAR ALL ON-FREQUENCY SIGNALS". Turn "on" the vehicle ignition switch and allow 1 minute for warm-up. For short transmissions it is not necessary to start the engine; however, to conserve the battery, the engine should be running. When the channel is clear, remove the microphone from the hang-up bracket. Hold it about one inch from the lips and turned about 30° away from the face. Press the push-to-talk button. The red lamp will come on and the transmitter will go "on the air". Speak slowly and clearly across the microphone in a normal or slightly louder than normal voice. At the end of the message, release the push-to-talk button and replace the microphone in the hang-up bracket.

TO TURN OFF

ALL MODELS	Place the ON-OFF switch in the OFF position--or turn the OFF-VOLUME control counterclockwise until a click is heard.

3. LOW CURRENT DRAIN MODIFICATION

In radios using control heads without pilot light dimmers, an additional saving in battery current drain of about 200 ma (in the standby condition) may be obtained by a wiring modification in the control head. If this modification is incorporated, the green pilot lamp will not operate until the transmitter is "keyed". Proceed as follows to complete the modification.

a. Loosen the two mounting screws and remove the control head.

b. Remove the 33 ohm, 2 watt resistor connected between a terminal on the rear of the OFF-VOLUME control or ON-OFF switch, depending on the model and the green pilot lamp socket.

c. Connect a 33 ohm, 2 watt resistor between the terminal with the brown lead attached to it on the red pilot lamp socket and the original connection on the green pilot lamp socket.

THEORY OF OPERATION

1. FUNCTIONAL OPERATION

The overall operation of the radio set is illustrated in the Functional Block Diagram in figure 1. This diagram applies to both dash-mount and trunk-mount installations.

The d-c input to the radio set is controlled by the control head power on-off switch and the vehicle ignition switch. The circuit from the ungrounded side of the battery through the vehicle ignition switch to the power on-off switch is the battery saver circuit.

When the power on-off switch is on, the battery voltage is applied to the receiver. This places the receiver in "standby" operation. At this time the green lamp on the control head will be energized.

When the power on-off switch and the ignition switch are both on, the radio is in the "receive" condition.

When the ignition and control head switches are on and the microphone push-to-talk button is pressed, the transmit-receive relay is energized. When the relay is energized, the radio set is in the transmit condition and the following functions are performed:

a. Battery voltage is applied to the power supply transistor switching circuit.

b. The antenna relay is energized and the antenna is switched from the receiver to the transmitter.

c. B++, B+ and A+ are applied to the transmitter (from the power supply).

d. The red lamp on the control head is energized to indicate the transmit condition.

When the microphone push-to-talk button is released in "Private-Line" tone-coded squelch models, the following functions are performed:

e. The transmitter remains "on" for approximately 150 milliseconds.

f. During this period of time, the transmitter carrier is modulated by an out-of-phase tone obtained through a "reverse burst" switching circuit, which damps the vibrations of the "Vibrasponder" resonant reed in the "listening" receiver and returns it to a squelched condition.

g. The transmit-receive relay and antenna relay release.

h. The transmitter goes off the air. The receiver is back in operation. The red light goes out.

2. RECEIVER

The receiver is a completely transistorized double-conversion superheterodyne type. It receives FM signals on one (or more) fixed, crystal-controlled frequencies.

Multi-frequency receivers are the same as one-frequency units, except for additional first oscillators and control circuits. Only one frequency can be received at a time. In selecting F1 on the control head, the d-c ground circuit to the #1 transistor oscillator is completed, permitting the stage to operate. At the same time, the d-c ground paths for the other oscillator

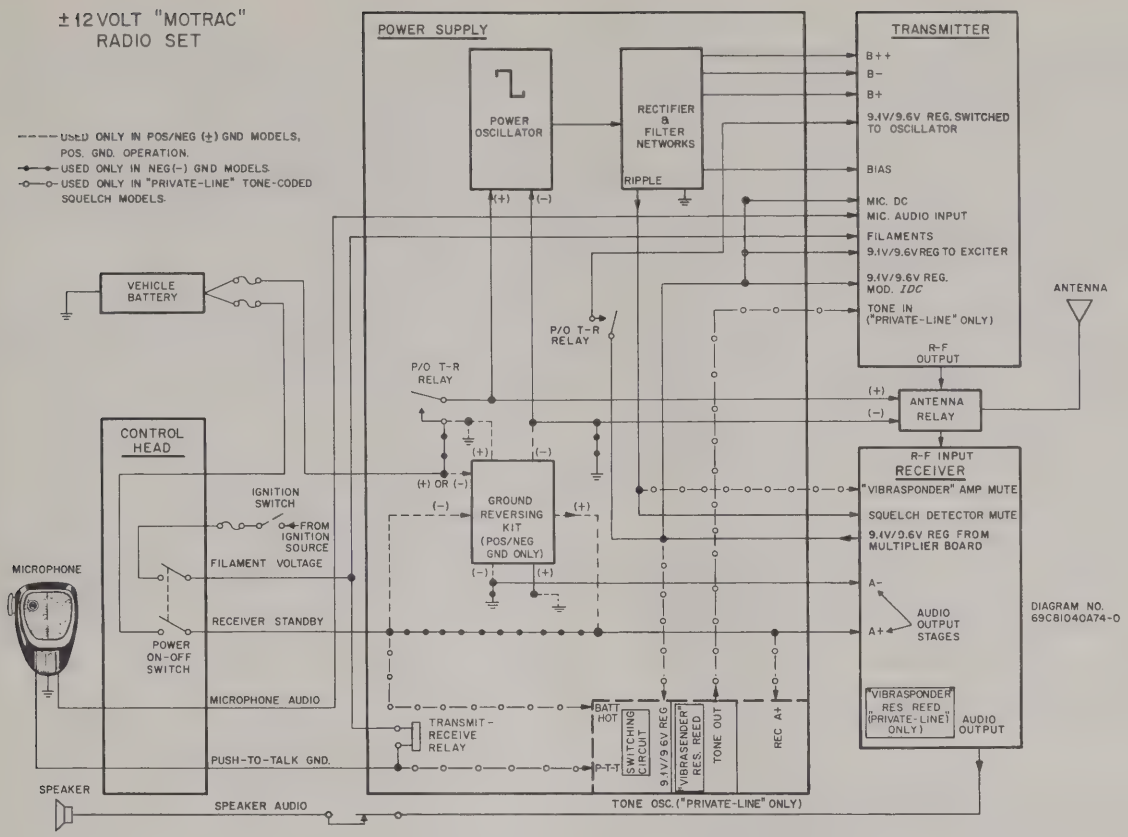


Figure 1. Functional Block Diagram

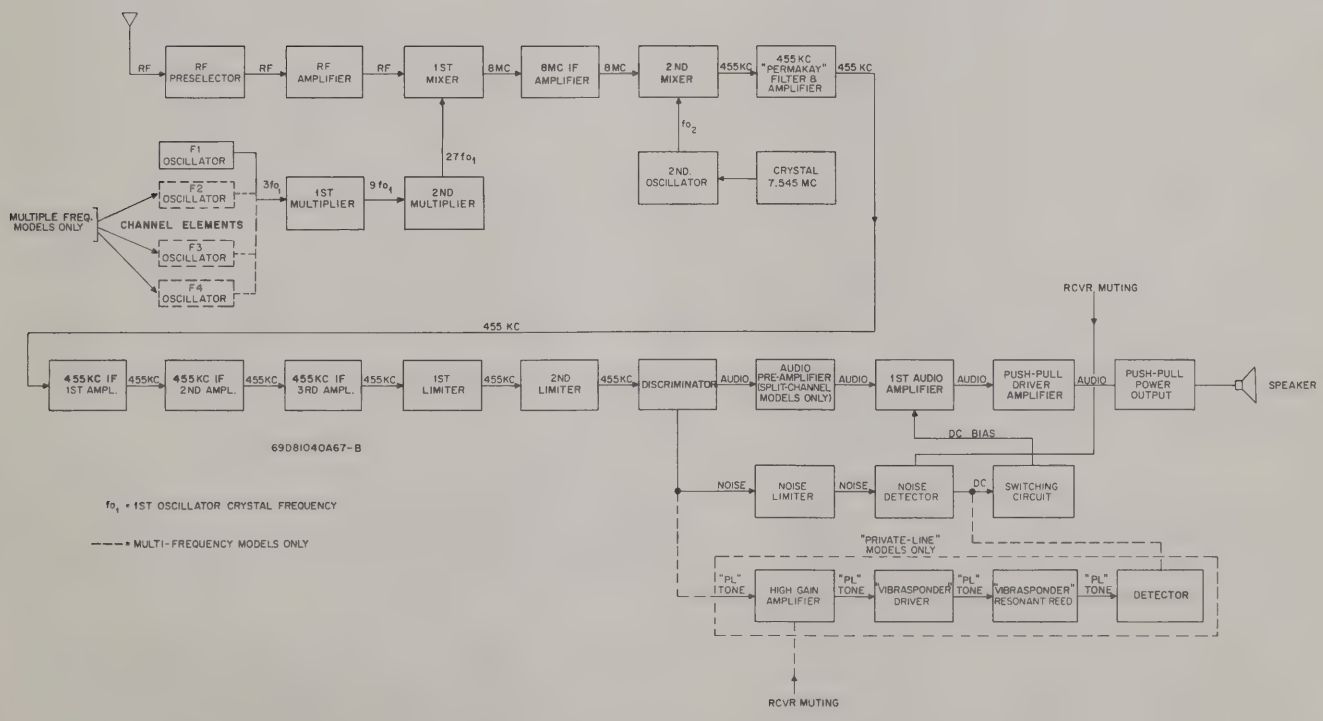


Figure 2. Receiver Block Diagram

stages are opened. As other frequencies are selected, a ground circuit is channeled to the appropriate oscillator.

a. RF Preselector and RF Amplifier

The r-f section of the receiver contains an r-f preselector and common emitter r-f amplifier stage.

The r-f preselector consists of six low loss, highly selective, helical resonant cavities. The preselector has a bandpass having a flat acceptance bandwidth and a steep skirt response to provide rapid attenuation of signals outside the acceptance bandwidth.

The carrier signals received at the antenna are coupled to the base of the r-f amplifier through the preselector cavities. The gain of this stage provides an optimum signal-to-noise ratio in the signals sent to the first mixer.

b. First Oscillator - Multiplier

The first oscillator circuitry is housed in a factory-sealed, temperature-compensated, plug-in module (channel element). The oscillator uses an unheated crystal operating on its fundamental mode in a Colpitts circuit with the output tuned to the third harmonic of the fundamental frequency. The output signal is filtered through a double-tuned circuit before it is applied to two transistor circuits which multiply it nine times. Consequently, the injection signal to the first mixer is 27 times the fundamental frequency of the crystal.

c. First Mixer

The first mixer amplifies and heterodynes the signal from the r-f amplifier with the signals from the first oscillator to produce the first intermediate-frequency (1st i-f) of 8 mc.

These frequency relationships can be expressed as follows:

$$f_c - 27f_1 = 8 \text{ mc}$$

r-f carrier input	mult. factor	channel element crystal freq.	1st mixer output (1st i-f)

$$f_1 = \frac{f_c - 8 \text{ mc}}{27}$$

d. First IF, Second Oscillator and Mixer

The first i-f circuit consists of a common emitter amplifier stage and five tuned circuits. The frequency of the first i-f is 8 mc. The output of the first mixer is coupled to the base of the first i-f amplifier through a selective double-tuned circuit.

The output of the i-f amplifier is coupled to the base of the second mixer through a highly selective triple-tuned circuit. Also applied to the base of the second mixer is the injection frequency of the second oscillator. The second oscillator frequency is controlled by a 7.545 mc crystal. The frequency of the second oscillator and the first i-f is maintained constant for all incoming signals at the antenna. The difference between the second oscillator frequency and the first i-f frequency is the second mixer output. This output is a 455 kc signal. The frequency relationships of these three stages are as follows:

1st i-f	8000 kc
2nd local osc. freq.	7545 kc
Difference freq. (2nd i-f)	455 kc

e. Second IF

A "Permakay" i-f filter containing a transistor amplifier stage is used in the second i-f circuit. The filter sections are permanently sealed in polyesterstyrene and the filter is unconditionally guaranteed for the life of the receiver, provided the seal is not broken and the housing is not tampered with. The amplifier circuitry is mounted to an eyelet board within the filter and is accessible for servicing. This filter is the major factor in determining the bandwidth and selectivity of the receiver. It greatly attenuates the signal outside the pre-determined bandpass. Three i-f amplifier stages follow the 455 kc filter to saturate the limiter.

f. Limiter Stages

The two limiter stages are 455 kc amplifiers arranged so that an increase in input signal produces no change in the amplitude of the output signal. The limiters are in full saturation at all times, that is, with weak or strong signals or noise only.

When a signal is applied to the N-P-N first limiter, the base is driven negative with respect to the emitter during the negative alternation of the signal. This places a reverse bias at the

emitter-base junction causing the collector current to drop to zero. During the positive half of the input signal, the base becomes more positive, increasing the emitter-to-collector current to its maximum value. Thus with a signal, the collector current is driven between cut-off and saturation. Operation of the second limiter is essentially the same except that the signal undergoes a phase reversal in the first limiter and the P-N-P transistor performs the same functions when its input signal is of opposite polarity. The output of the limiter is a signal of constant amplitude.

g. Discriminator

The discriminator used is a phase discriminator, that is, the operation is dependent upon a 90° phase shift which occurs at resonance between the primary and secondary voltages of the tuned transformer.

The discriminator recovers the audio from the 455 kc i-f signal. A typical discriminator response curve is shown in figure 3.

The i-f signal varies in frequency at the audio rate. This is shown below the curve. The corresponding audio output is drawn to the right of the curve.

h. Noise-Actuated Squelch Circuit

The purpose of the squelch circuit is to eliminate disturbing noise which would otherwise be heard at the speaker during intervals between received messages.

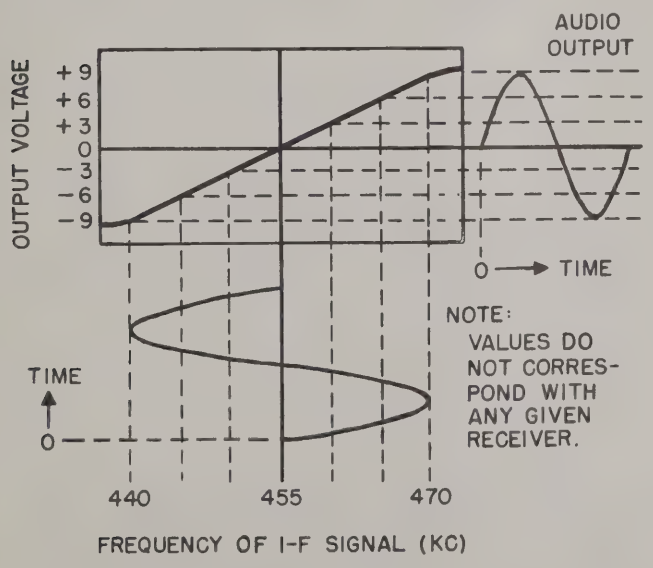


Figure 3.
Typical Discriminator Response

The noise-actuated squelch circuit consists of a noise limiter, noise detector (rectifier) and transistorized d-c control stage (switching circuit).

In the absence of a received r-f carrier (SQUELCH control at threshold), noise from the discriminator is amplified by the noise limiter. This noise voltage is rectified in the form of drawing more or less current in the noise detector stage. More current is drawn when the receiver is fully squelched (SQUELCH control fully clockwise); less current is drawn when the receiver is unsquelched.

When the noise detector is drawing heavy current, a less positive voltage is developed at the emitter element of the detector. This causes a heavy forward bias to be applied to the switching transistor which results in a heavy current through the transistor. This, in turn, reverse biases the first audio amplifier stage, cutting off the stage. Therefore, the following audio stages do not receive signals and the speaker is quiet.

When an "on-frequency" signal is received, the noise reaching the squelch circuit diminishes entirely, so that there is little or no output from the noise detector. As a result, the d-c control stage appears as an open switch and the audio amplifier is biased normally allowing the incoming signals to reach the speaker.

i. "Private-Line" Tone-Coded Squelch Circuit

The "Private-Line" ("PL") squelch circuit consists of a low-pass filter network, a high-gain amplifier, an amplifier and clipper, a "Vibrasponder" resonant reed, an output amplifier, a detector and a driver stage.

The output from the discriminator is connected to the low-pass filter network, which passes frequencies below 300 cps. The low-frequency signals ("PL" tone) are amplified and coupled to the input of the "Vibrasponder" amplifier and clipper. The amplifier and clipper stages provide the output required for driving the resonant reed. Thus, in "Private-Line" operation the r-f carrier is always modulated by the assigned, "PL" tone, which after being detected and amplified, energizes the resonant reed. If a different tone is present with the r-f carrier, the reed will not respond due to its highly selective design. The amplifier and clipper output is applied to the resonant reed coil through a resistor and capacitor to complete the "PL" tone path. The resonant reed is permanently tuned and sealed at the factory.

The reed vibrates in response to the incoming tone signal from the transmitter. The vibrating reed produces a sinusoidal output which is amplified and detected. The detected output is filtered by the driver stage to provide a d-c voltage for biasing the switching transistor. The low-pass filter is paralleled by a high-pass circuit to prevent erratic action of the "Vibrasponder" resonant reed circuit caused by noise. When the proper tone signal is received and the audio amplifier is "turned on", the high-pass path is shorted to ground through a diode that is forward biased.

The squelch control is not used in "Private-Line" operation and the setting of it does not affect the "Private-Line" squelch circuit. However, in "PL" OFF operation, the squelch control does affect operation of the noise-actuated squelch circuit and should be set for squelch threshold.

In "Private-Line" tone-coded squelch models with the "PL" switch ON, the noise squelch circuit is disconnected from the discriminator output and forward bias is applied to the switching transistor. Thus only the "PL" squelch circuit is usable. When the "PL" squelch circuit output is applied to the base of the switching transistor, the transistor is biased to cut-off and appears as an open switch. Under open switch conditions, less current is drawn through the emitter resistor of the switching transistor and the first audio amplifier is biased normally, allowing the incoming signals to reach the speaker.

In "Private-Line" tone-coded squelch models with the "PL" switch in the OFF position or in carrier squelch models, the discriminator noise output is connected to the input of the noise-squelch circuit, through the SQUELCH control on the control head, and the fixed forward bias is removed. Under these conditions, the noise-squelch circuit output is applied to the base of the switching transistor, biasing it into conduction. Therefore, any carrier (modulated or unmodulated) will activate the noise-squelch circuit and pass the signals on to the speaker.

In "Private-Line" tone-coded squelch models, the "PL" squelch circuit is operative at all times. The "PL" switch on the control head actually switches the noise-squelch circuit in or out.

j. Audio Circuit

Audio signals from the discriminator are coupled to the first audio stage through the VOLUME control. The VOLUME control varies the signal level applied to the base of the first audio amplifier (audio pre-amplifier in split-channel models). The audio signals are amplified in the push-pull driver amplifier stage and further amplified in the push-pull power output stage. The output stage provides a 5 watt output to a 3 ohm speaker with less than 5% distortion. Response is within +1, -8 db of the 6 db per octave de-emphasis characteristic between 300 and 3000 cps.

k. A+ Regulator

The A+ regulator circuit essentially consists of a constant current source and a shunted Zener diode, CR7. Diodes CR9 and CR10 and resistor R91 provide a fixed voltage drop from emitter to base of Q13, which in turn produces a constant collector current to feed diode CR7 and the load. The output of the regulator is 9.1 volts when used in 1-frequency models and 9.6 volts when used in 4-frequency models.

3. TRANSMITTER

The transmitter consists of one (or more) crystal-controlled oscillators, a phase-modulator, several amplification and frequency multiplication stages and a final power amplifier stage. The fundamental crystal frequency is multiplied 36 times to provide the final r-f amplifier output frequency.

The Transmitter Block Diagram, figure 4., shows the stage-by-stage signal flow and operating frequencies.

a. Microphone and Pre-amplifier Circuit

The transmitter usually incorporates a Motorola dynamic microphone with a self-contained, transistorized pre-amplifier. The microphone cartridge and pre-amplifier act as a variable voltage generator producing an output voltage which varies with both frequency and intensity as the sound waves strike the diaphragm.

b. Deviation Limiting Circuit

In the incoming signal from the microphone, the wavefront slope depends upon both amplitude and frequency. The overall effect of the deviation limiting circuit is to place a barrier upon the maximum wavefront slope which can pass into the modulator.

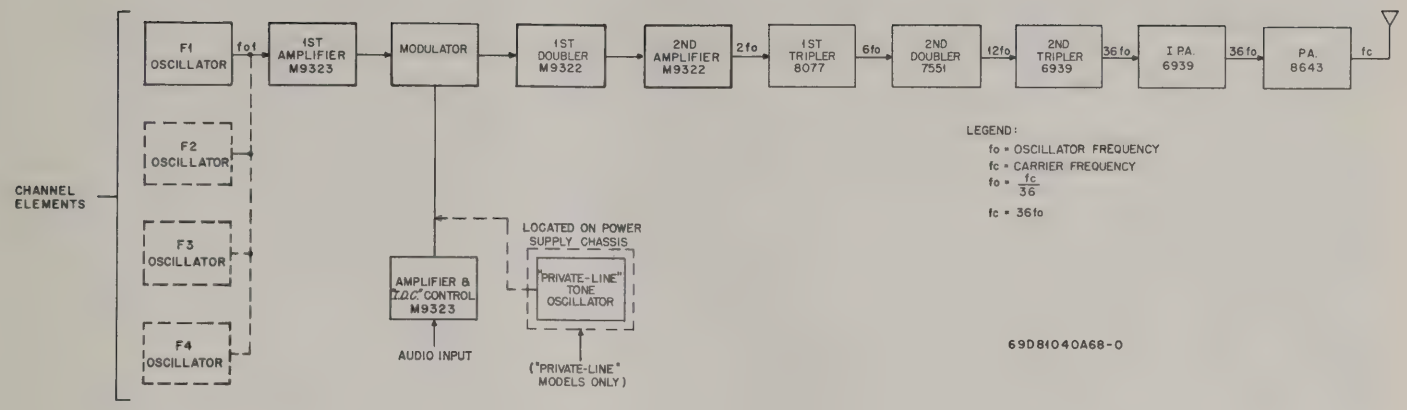


Figure 4. Transmitter Block Diagram

The deviation limiting circuit consists of components for pre-emphasizing (6 db/octave characteristic), amplifying and limiting, and then de-emphasizing the modulation signal. The amplifier stage clips both positive and negative peaks when they exceed the pre-determined clipping level. The audio wave passes through a low-pass filter to the IDC ("Instantaneous Deviation Control") control. Except for slope limiting, the output waveform of the deviation limiting circuit is identical to the input waveform. The amplifier and deviation limiting circuit limits deviation by controlling the maximum slope of the signal wavefront which reaches the modulator. This controls transmitter maximum deviation, since the modulator frequency shift is proportional to the slope of the audio input waveform.

c. Oscillator (Channel Element)

Since the crystals in the channel elements are unheated, each transistor oscillator circuit is individually compensated for frequency stability over the entire temperature range. The entire assembly is housed in a factory sealed, plug-in unit. For multiple-frequency radios, separate oscillator circuits are incorporated. The frequency selector completes the dc ground path for the desired oscillator. Each of the oscillators is supplied with a 9.1- or 9.6-volt regulated voltage when the transmit relay is activated.

Variable "warp" capacitors are mounted in the base of the channel element and are accessible through the circuit board. Each oscillator operates on a specific frequency in the 12.5 to 13.056 mc range.

d. Modulator

The audio output of the deviation limiting circuit is applied to the modulator which phase modulates the output of the oscillator. The tuning elements of the modulator tank circuits are varactors. The capacitance of these special reverse biased diodes is a function of the potential across them. The audio signal is applied to the varactors which changes this potential at an audio rate and varies the capacitance in the modulator tank circuit. This changes the phase angle of the r-f signal producing modulation.

e. Multipliers and Amplifiers

The modulator output is applied to the 1st doubler where the signals are amplified and doubled in frequency. They are further amplified and tripled in frequency in the 1st tripler, doubled again in the 2nd doubler and tripled in the 2nd tripler. The intermediate power amplifier stage develops the required signal power to drive the power amplifier to its rated r-f power output. The signals reaching the final amplifier have been multiplied 36 times from the original frequency generated by the oscillator.

f. "Private-Line" Tone Generator

This tone generator consists of a transistorized two-stage oscillator and "reverse burst"

switching circuitry. The frequency determining element of the oscillator is a Motorola "Vibrasender" resonant reed (an electro-mechanical equivalent of a parallel-tuned high Q tank circuit). The oscillator operates continuously when the radio set is turned on.

The oscillator circuit is made up of Q704, Q705, the "Vibrasender" resonant reed and the bias circuitry. The tone output is taken from the collector of Q705 or from resistor R724 in the emitter circuit of Q705. The selection of these two paths is determined by diodes CR710 and CR711. When the transmitter is keyed, the push-to-talk lead is connected to the grounded battery terminal. The diode bridge (comprised of CR701, CR702, CR703 and CR704) causes Q701 to turn on. When this happens, CR710 becomes reverse biased and CR709 is forward biased through R728, R730 and R731. The tone oscillator output is now taken from R724. When the push-to-talk button is released, Q701 is turned off and CR710 is now forward biased through R725, and R729. Diode CR709 becomes reverse biased and the tone output is now taken from the collector of Q705. The 180° phase shift between the two tone paths gives a "reverse burst" of tone just after the push-to-talk button is released. This tone prevents "squelch tail" from occurring in the receiver by quickly damping the "Vibrasponder" resonant reed. Even though the push-to-talk button is released, the transmitter remains "on" for approximately 150 milliseconds so that the "reverse burst" of tone may be transmitted. This delay is accomplished by Q702 and Q703 which comprise the "reverse burst" switching circuitry. When the transmitter is keyed, Q701 and Q703 are immediately turned on. Q703 supplies current to the transmit-receive relay which turns on the power supply. When the push-to-talk button is released, Q701 and Q702 are turned off but Q702 turns on again after capacitor C701 is discharged through R704 and R705. It should be noted that during the discharge time (approximately 150 milliseconds) Q702 is off and Q703 is on. Finally, as Q702 is turned on, Q703 is turned off. This action removes the voltage from the relay which turns off the power supply and the transmitter.

4. POWER SUPPLIES

The "Motrac" radio set power supplies are fully transistorized, d-c to d-c converters capable of developing high voltage d-c outputs from a low voltage d-c source. They produce the operating voltages for the transmitters. Power supplies in "Private-Line" radio sets also contain the "Private-Line" tone generator circuit. Operating voltages for the receiver are supplied directly from the vehicle battery and are independent of power supply operation.

The voltage outputs of the supplies are produced by three separate rectifier and filter networks. The networks develop the bias and supply voltages required by the tube section of the transmitter. AC signals are also derived from one rectifying network for application to the receiver squelch circuit when the transmitter is on, providing a muting function. In addition, operation of the transmit-receive relay provides a muting function for the audio section of the receiver and supplies a switched voltage to the exciter section of the transmitter.

The power supplies can operate on either negative or positive ground power sources. In negative ground operation, a Model TLN6832A Negative Ground Kit is supplied with the radio. For positive/negative ground requirements, a Model TLN8482A Ground Reversing Kit is available on special request.

a. Receiver Power

The 12 volt d-c battery voltage is supplied to the receiver via the control head ON-OFF switch and the power supply interconnections. The input is routed through the negative ground kit or the ground reversing kit. A voltage of positive polarity is always applied to the receiver when the ON-OFF switch is ON. This independent operation of the receiver reduces the battery drain during the receive mode of operation.

b. Transmitter Power

Transmitter filament voltage is applied from the battery when the vehicle ignition switch is turned on. Activation of the push-to-talk switch operates the transmit-receive relay. This relay accomplishes the following functions: (1) battery voltage is applied to the transistor switching circuit; (2) a speaker lead is opened to mute the receiver audio and (3) regulated 9.1 or 9.6 volts is coupled to the transmitter channel elements.

c. Transistor Switching Circuit

When the transmit relay is energized, A+ is applied to the emitters of all power transistors. The input voltage is across these banks of transistors and their associated half of the transformer primary winding to A-.

The transistor switching circuit consists of two parallel transistor banks. The bases of each bank of transistors are connected to the feedback bias circuit. One bank of transistors always conducts more than the other bank when the input voltage is first applied. The polarity of the voltage induced in the feedback winding is such that the bank of transistors which begins to conduct more than the other bank is quickly driven to full conduction. The other bank is quickly cut off. Current flows through the conducting bank of transistors and their associated half of the transformer primary winding until the transformer core is saturated, at which time the voltage induced in the feedback winding reverses in polarity. The cut-off bank of transistors is quickly driven to conduction through its associated half of the transformer primary winding; the first conducting bank of transistors is quickly driven to cut-off. Conduction continues until the transformer core is saturated again. Then the cycle is reversed and repeated. This causes current to flow alternately in opposite directions through the two half-windings of the primary. The circuit is designed for continuous, self-sustaining oscillation as long as the d-c input is applied. The switching action is very rapid and the induced voltages approximate an ideal "square wave".

The secondary windings of the transformer provide the various voltages required for operation of the transmitter.

(1) Starting Circuit

The starting circuit consists of two resistors and a capacitor. A small amount of forward bias is applied to both banks of transistors by the capacitor. This forward bias starts the transistor conduction. Since there is never equal conduction in all transistors, one bank will conduct more than the other. The heavier conducting bank is driven to saturation and the other bank is quickly driven to cut-off.

(2) Feedback Circuit

The feedback circuit consists of the transformer feedback winding, a resistor and the base to emitter junction of the transistors. This circuit is a closed loop within the oscillator. The resistor determines the amount of drive current fed back from the bases of the transistors. It also determines the maximum power which can be drawn from the secondaries of the transformer.

d. Rectifier and Filter Networks

The transmitter B+ rectifier-filter network converts the a-c high voltage induced in the transformer secondary to the ripple free d-c output required for the transmitter. The circuit contains a silicon diode bridge rectifier and an LC filter. The B+ output is applied to the transmitter driver stages and the PA screen.

The transmitter B++ is supplied from a second rectifier and filter network. The network consists of a silicon diode bridge and a pi-type filter. The bridge is placed in series with the output of the B+ bridge rectifier so that the d-c voltages are cumulative. Connection to the proper tap on the power transformer secondary winding provides the required voltage output.

The transmitter bias network includes a low voltage secondary winding of the power transformer, a half wave rectifier and an RC filter and voltage divider. The negative bias voltage is applied to the transmitter driver and power amplifier grid circuits.

e. Audio Muting Circuit

To mute the receiver during transmit, a speaker lead from the audio output stage is opened by a relay contact. To further mute and prevent a squelch tail noise burst immediately following transmission, an a-c voltage from the power transformer is fed back to the base of the squelch detector. This voltage replaces the squelch noise which is quieted when the transmitter and receiver are on the same frequency and the transmitter is "on". Immediately after transmit, the time constants in the squelch circuit are such that the receiver noise builds up at the same time the a-c voltage from the power supply decays. This keeps the first audio amplifier cut off until the noise has recovered sufficiently for proper squelch action. In "Private-Line" models, additional a-c voltage is fed to the base of the "PL" amplifier, Q750. This signal desensitizes the "Vibrasponder" reed, de-activating the circuit during transmit so that the squelch elimination is not overriden and functions properly.

f. Reverse Polarity Protection

The radio set is protected against accidental application of reverse polarity input voltages. If a reverse polarity input is inadvertently applied, a fuse in the vehicle battery line to the receiver

opens, protecting the receiver. A diode on the polarity reversing plug also provides positive protection for the power supply. No current can flow through this reverse biased diode in this condition, the transmit-receive relay cannot be energized, and no voltage is applied to the power supply transistors.

5. MULTI-FREQUENCY MODELS

a. Standard Applications

Multi-frequency radio sets are generally the same as one-frequency models, except for additional channel elements, four-position frequency selection on the control head and an additional printed circuit board located in the power supply. This board contains the F3 and F4 receiver channel elements. It provides filtering in the F3 and F4 transmitter channel element switching leads and isolation diodes for each frequency switching lead. All four transmitter channel elements are located in the power supply. The transmitter and receiver F1 channel elements are electrically connected through two isolation diodes to the F1 position of the single-pole four-position frequency selector switch on the control head. All other receiver and transmitter channel elements are similarly connected to respective positions on the frequency selector switch. A diode in series with the 8.8-volt Zener diode compensates for the loss across the diode in the frequency switching lead. Therefore, the +9.4-volt regulated d-c output of the regulator circuit (ground reference) results in the required +8.8 volts d-c across the channel element. The transistorized constant current source in series with the 8.8-volt Zener diode prevents the diode from dropping out of regulation at -15% battery input voltage.

b. Field Conversion for Other Applications

NOTE

FCC approval must be obtained before adding or changing frequencies.

Radio sets having less than four transmitting and/or receiving frequencies are possible by using less than the full complement of channel elements. For example, a radio set may have two transmitting frequencies and four receiving frequencies (T2-R4 operation). On such radio sets, jumpers are added at appropriate points on the printed circuit board to permit alternate-frequency operation on the positions without channel elements. For example, a T2-R4 radio set can be jumpered so that one of the two available transmitting frequencies can be transmitted in each position of the F1-F2-F3-F4 frequency selector switch. The isolation diodes in the frequency switching leads prevent d-c interaction between channel elements. The basic jumper connections for each type of operation are listed in the jumper table on the F3 and F4 circuit board detail. However, a large number of variations are possible for each type of operation by changing the positions of the channel elements and changing the jumper connections. As an example, the basic jumper connections for T1-R4 operation provide transmission of the T1 frequency in all four positions of the frequency selector switch. If another form of T1-R4 operation is desired, such as transmit and receive on the F2 and F4 positions and receive only on the F1 and F3 positions, the basic jumper connections cannot be used. Proper jumper connections and location of channel elements for this and all types of operation can be calculated from the following procedures and typical examples.

To receive the same frequency on more than one position of the frequency selector switch, jumper the corresponding points together on the printed circuit board.

EXAMPLE 1

Condition Desired:

462.750 mc on F1 and F4 positions
462.800 mc on F2 position
462.850 mc on F3 position

Procedure:

Jumper point R1 (refer to the circuit board detail) to point R4 on the printed circuit board. Plug the 462.750 mc channel element into the receiver F1 position. No channel element is used in the receiver F4 position. Plug the 462.800 and 462.850 channel elements in the F2 and F3 positions respectively.

EXAMPLE 2

Condition Desired:

462.750 mc on F1 and F3
462.850 mc on F2 and F4

Procedure:

Jumper point R1 to R3 and plug the 462.750 mc channel element into the receiver F1 position and none into the F3 position. Jumper point R2 to R4 and plug the 462.850 mc channel element into the receiver F2 position and none into the F4 position.

To transmit the same frequency on more than one position of the frequency selector switch, jumper the corresponding points together on the printed circuit board.

EXAMPLE 3

Condition Desired:

462.750 mc on F1
462.800 mc on F2 and F4
462.850 mc on F3

Procedure:

Jumper point T2 to T4 on the board. Plug the 462.800 mc channel element into the transmitter F2 position. No channel element is used in the transmitter F4 position. The transmitter F1 and F3 channel elements are installed in the normal manner. Refer to the jumper table on the F3 and F4 Circuit Board Detail supplied with the instruction packet.

6. GROUND REVERSING KIT

a. Description

These kits, available on special request, adapt "Motrac" radio sets to vehicles with either negative or positive ground electrical systems.

The units consist of a converter circuit mounted in a compact housing with a plug for insertion into a receptacle located in the radio set power supply. Rotating the unit 180° and reinserting it into the power supply receptacle adapts the radio set for the opposite input polarity. The two input polarities are marked on the unit at opposite ends and an arrow on the power supply transformer identifies the orientation of the unit with respect to vehicle electrical system polarity.

b. General Circuit Operation
(Refer to Detail EPD-14830)

When the ground reversing kit is positioned for positive ground operation, a multivibrator switching circuit feeds the input current into the primary side of a toroid transformer. To produce 12 volts referenced to the chassis, the output from the transformer secondary (approximately 15 volts) is rectified, filtered and referenced to the battery positive terminal, which is the radio chassis. A limiter circuit in the output of the unit prevents damage to the switching transistors under a shorted output condition.

DC starting is provided by resistor R202, which feeds current from the positive input through the base-drive windings of the transformer to the base of the switching transistors. Reverse polarity protection is provided by the series diode CR202, in the primary circuit negative-return lead. For negative ground operation, the converter circuitry in the ground reversing kit does not operate and the kit operation is identical to that of a negative ground only kit.

c. Starting and Running

When voltage is applied to the converter, assume that Q201 conducts more than the other switching transistor because of a small imbalance in the circuit. The resulting increase in voltage across the primary of the transformer induces a voltage in the feedback winding of a polarity that will cause transistor Q201 to be driven into saturation and Q202 to be reverse biased and driven into cutoff. As the transformer saturates, causing no change in the flux density, the drive to the base of Q201 is reduced and the collector current begins to decrease. This causes a change in flux in the opposite direction that drives Q201 into cutoff and forward biases Q202, turning it on. Q202 then operates as Q201 did in the initial half cycle.

d. Output Circuit

The output limiter circuit uses Q204 as a short-circuit detector to control the base drive of a saturated switching transistor Q203 connected in series with the positive output lead. If the output is short circuited, the output voltage falls and removes the drive voltage to the short-circuit detector Q204. As Q204 turns off, the base drive to Q203 is removed forcing it into cutoff. This causes the 680-ohm resistor R205, connected from the collector to the emitter of Q203, to appear as the load so that the converter operates correctly with a 680-ohm load instead of a short circuit load.

e. Conversion of Negative Ground Only Radio Sets to Positive or Negative Ground Operation

Remove existing plug P201 (TLN6832A Negative Ground Kit) from the power supply and replace it with the TLN8482A Ground Reversing Kit. Insert this plug-in unit so that the arrow on the power supply transformer points to the same ground polarity on the kit as that of the vehicle electrical system.

7. PILOT LIGHT DIMMER

(Only on optional control heads with dimmer; refer to applicable schematic diagram.)

The pilot light dimmer circuit automatically controls the brilliance of the green (receive) and red (transmit) pilot lights mounted on the control head. In bright daylight, the lights glow brightest to insure visibility. The lights become progressively dimmer to reduce excessive glare as daylight changes to darkness. External illumination is sampled through a window in the lower portion of the control head and acts upon a light dependent resistor which is mounted behind the window.

During receive operation, transistor Q501 conducts. Its collector current also flows through the series connected green pilot light, DS501. The stage operates from the source voltage available at the 7-1/2 ampere fuse. Light dependent resistor (LDR) R512, which is located in the resistive network between the base of Q501 and the positive voltage applied through the on-off switch, controls the base current of Q501 to ultimately control the total current through the green pilot light. The resistance of the LDR is controlled by the amount of light striking it (the resistance decreases as the light intensity increases and vice versa). During daylight operation (LDR resistance low), the collector current of Q501 is high and the light glows brightly. During night time operation (LDR resistance high), the collector current of Q501 is low and the light glows dimly.

When the transmitter is keyed, a ground is applied from the microphone push-to-talk switch to the dimmer circuit at microphone connector J501-3. The ground completes a path for base current of transistors Q502 and Q503, causing both transistors to conduct. As Q503 conducts, its emitter voltage drops and CR503 becomes reverse biased and blocks the current path for Q501. Simultaneously, Q502 conducts and provides an alternate current path for Q501. A series current path is provided through Q501 (N-P-N) and Q502 (P-N-P) collectors and the associated red and green pilot lights. The series stages operate from the source voltage available at the 6-1/4 ampere fuse. Both lights turn on, but the intensity of both is controlled by the base current of Q501 as described previously for receive operation.

8. TIME-OUT TIMER

a. Description

The time-out timer prevents the transmitter from staying on beyond a predetermined period. At the end of this time, the transmitter is automatically disabled and the operator is notified by an alert tone. The time-out period is selected by jumpers on the timer circuit board. The jumpers are visible on the plating side of the board and it is not necessary to remove the board to change the time period. Radios are shipped from the factory with the time period set for 30 seconds.

b. General Circuit Operation
(Refer to Schematic Diagram)

When the push-to-talk switch is actuated, power is supplied to the transmitter and B+ is applied to the time-out timer. The regulator bulb maintains a constant voltage to the input of the timing circuit. Timing does not change with fluctuations in radio set primary voltage. This regulated voltage is coupled through one or more resistors to the timing capacitor. The series resistors determine the rate of charge of this capacitor. When the voltage across the capacitor builds up to the ionization voltage of the trigger bulb, the bulb "fires" and allows a pulse of current to turn on the transistor switch. The conduction of the transistor provides a closed circuit path for the relay. The relay energizes and performs the following functions.

(1) Switching transistor is by-passed and relay is "locked up".

(2) Power supply transistor bias is disabled.

(3) B++ is shorted to ground. The power supply "stalls" and the charged timing capacitor discharges through the B+ bleeder circuitry.

(4) Receiver audio output stages are made to oscillate.

(5) Circuit to speaker is closed and an alert tone is heard.

Once the tone starts, it will remain on as long as the push-to-talk switch is actuated. Upon releasing the switch, the tone will immediately stop, the time-out circuit will fully reset and the radio set is ready for transmission.

SERVICE AIDS

Complete removal of the printed circuit boards for access to components is not always necessary. For instance, the audio board in the receiver may be partially disconnected and folded out.

The following steps outline procedures to prepare various parts of the radio set for servicing. Observe standard servicing practices such as tagging of leads and identification of connecting points. Refer to the SERVICE DIAGRAMS supplied with the radio set for lead identification and routing.

NOTE

The letters and numbers that appear in the boxes near the photographs, indicate corresponding steps in the following paragraphs. Example: [a. (1)] in figure 5. indicates the location of items discussed in sub-paragraph "a. (1)".

1. RECEIVER

(Remove oscillator cover shield.)

a. 8 MC IF and 2nd Oscillator Board (Figure 5)

(1) Unsolder r-f output coaxial lead.

(2) Unsolder injection coaxial lead from the 1st oscillator board.

(3) Unsolder two filter leads.

(4) Unsolder three ground leads.

(5) Remove two mounting screws and fold out board.

b. 1st Oscillator Board (Figure 5)

(1) Unsolder the 1st oscillator injection coaxial lead.

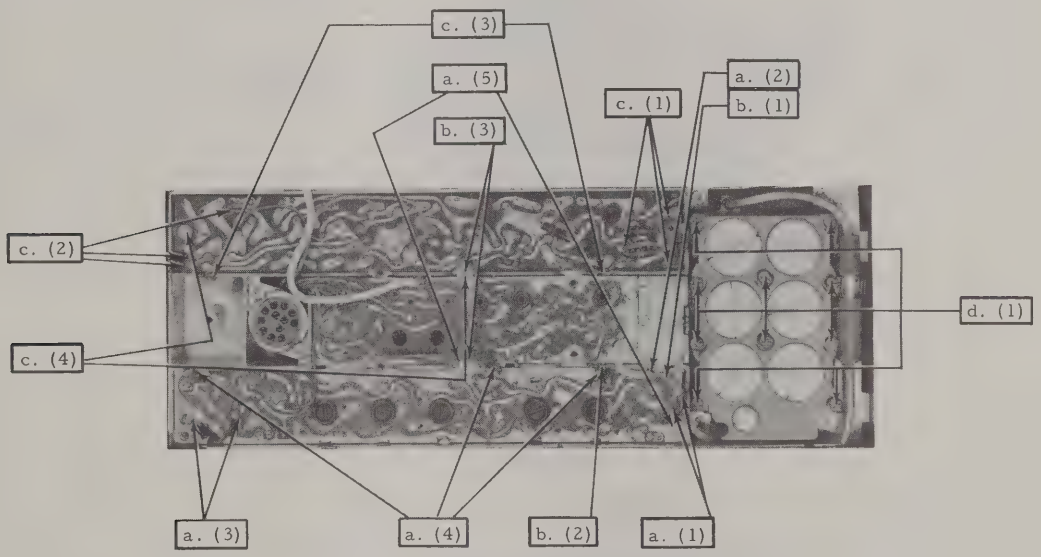


Figure 5.

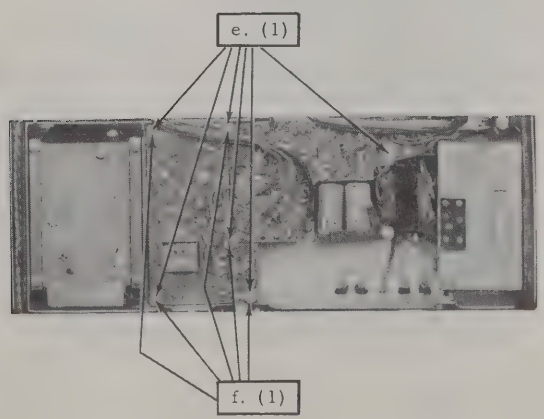


Figure 6.

(2) Unsolder ground lead.

(3) Remove two mounting screws.

(4) Remove channel elements and fold out board.

c. 455 KC Board (Figure 5)

(1) Unsolder discriminator lead (GRN-RED) and meter leads (WHT-GRN and WHT-YEL).

(2) Unsolder three filter leads.

(3) Unsolder two ground leads.

(4) Remove two mounting screws and fold out board.

d. RF Amplifier Circuitry (Figure 5)

(1) Remove ten mounting screws from r-f preselector and lift off top half.

(2) Unsolder r-f amplifier collector lead.

(3) Unsolder capacitor C1 from L6.

(4) Remove two mounting screws and lift out amplifier plate.

e. Audio Board (Figure 6)

(1) Remove three mounting screws (six screws in "PL" radios).

(2) Lift and fold out board(s).

f. "Private-Line" Decoder and Filter Board (Figure 6)

(1) Remove five mounting screws.

(2) Lift and fold out board.

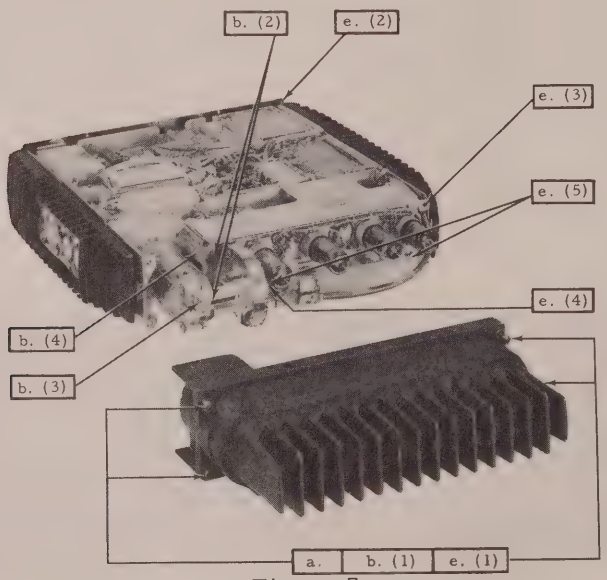


Figure 7.

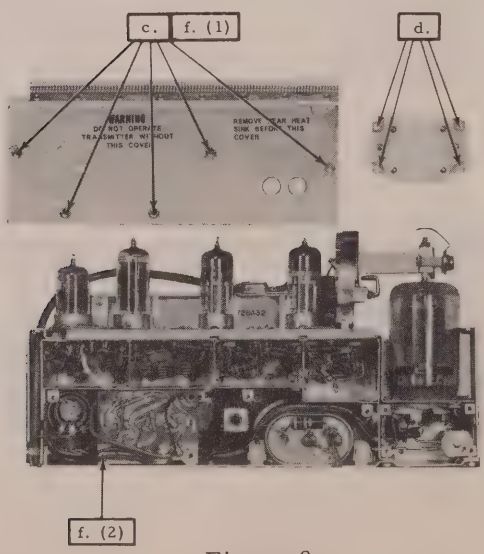


Figure 8.

2. TRANSMITTER

a. 1st Tripler, 2nd Doubler, 2nd Tripler and I.P.A. Tubes (Figure 7)

Loosen four captive screws and remove rear heat sink.

b. Power Amplifier Tube (Figure 7)

(1) Loosen four captive screws and remove rear heat sink.

(2) Remove two mounting screws.

(3) Lift up on plate tank circuit.

(4) Release hold down spring and remove tube.

c. Access to Bottom of Exciter Board (Figure 8)

Remove five screws and slide exciter bottom cover out.

d. Access to Bottom of Power Amplifier Section (Figure 8)

Remove four screws and lift off power amplifier cover.

e. Removal of Harmonic Filter (Figure 7)

(1) Loosen four captive screws and remove rear heat sink.

(2) Remove input lead to harmonic filter from antenna.

(3) Remove screw and spread apart chassis to allow room for removal of coaxial connector.

(4) Remove harmonic filter output lead.

(5) Remove two mounting screws and lift out harmonic filter.

f. Access to IDC Filter Board (Figure 8)

(1) Remove five screws and slide exciter bottom cover out.

(2) Remove one screw and fold out board.

g. Access to Top of Exciter Board (Figure 9)

Remove six screws and slide exciter top cover out.

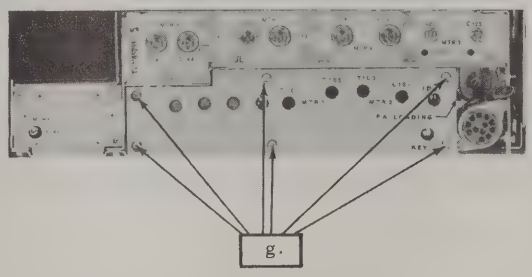


Figure 9.

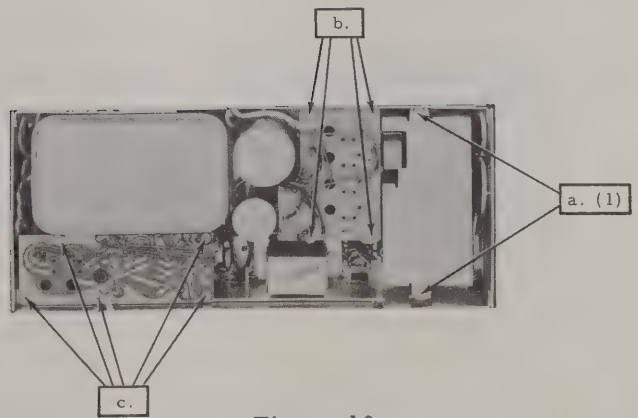


Figure 10.

3. POWER SUPPLY

a. Tone Generator ("Private-Line" Models Only)

(1) Loosen two screws until tone generator can be lifted from its mounting location (figure 10.).

(2) Lift out tone generator and fold back (figure 11.).

(3) Remove five mounting screws and fold board away from chassis (figure 11.).

b. Channel Element Board (Figure 10)

Remove four mounting screws and fold out board.

c. 3rd and 4th Frequency Receiver Oscillator Board (Figure 10)

Remove five mounting screws and fold out board.

d. Rectifier and Filter Board (Figure 12)

(1) Unsolder GRN-YEL, GRN-BLK, RED, BLK, RED-WHT, RED-WHT-BLU and bare lead.

(2) Remove four mounting screws and lift out board.

4. ACCESSORY CONVERSION INSTRUCTIONS

a. General

The following instructions are for converting ±6 volt "Motrac" radio set accessories for ±12 volt operation.

The ±6 volt control head of a "Motrac" radio set can be modified to operate from a ±12 volt electrical system. On trunk mount radio sets, the cable kit must also be modified. These modifications enable the accessory items to be transferred from a vehicle with a ±6 volt electrical system to a vehicle with a ±12 volt electrical system.

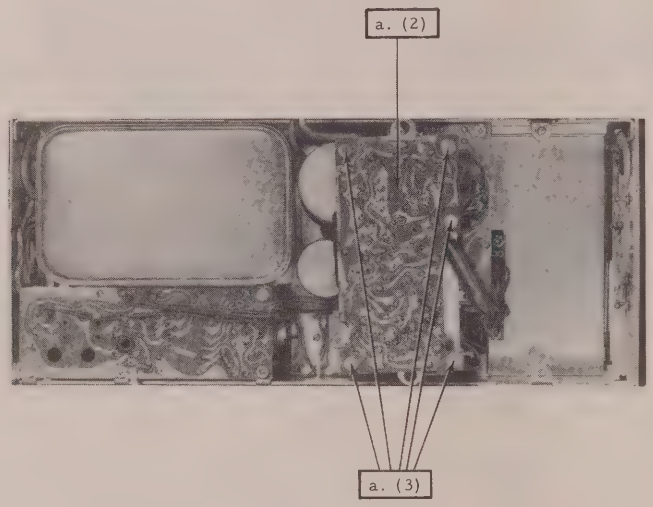


Figure 11.

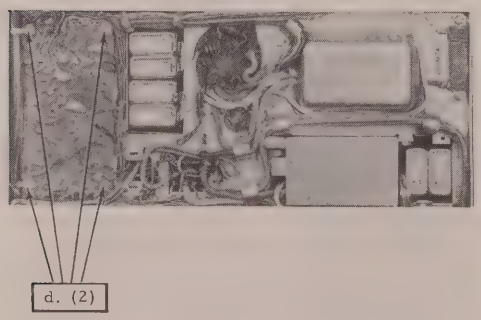


Figure 12.

b. Conversion Instructions

The following tables list the various control heads and cable kits that can be converted. The modifications required to convert a control head or cable kit are indicated by numbers in the MODIFICATION PROCEDURE NO. column of each chart. These numbers pertain to the procedures that follow these tables.

c. Modification Procedures

(Refer to the radio set schematic diagram)

(1) Replace the two 6 volt indicator lamps with 12 volt lamps (Motorola Part No. 65R4151).

(2) Remove diode CR501 and make a straight through circuit connection.

(3) Move the lead from pin 18 of receptacle J502 to pin 4 of this receptacle.

(4) Replace fuse F501 with a 7.5 amp non slow-blow fuse (Motorola Part No. 65K86099).

(5) Replace fuse F502 with a 35 amp. non slow-blow fuse (Motorola Part No. 65B83578C01 or 65B83579C01 fuse and 43A831204 fuseholder adapter).

(6) Move the ORG control head cable attached to the exterior fuse block, to the accessory or "on" position of the ignition switch.

(7) Remove the BLK jumper connected across resistors R501 and R502.

(8) Transpose the leads connected to pins 4 and 18 of receptacle J502.

(9) Replace fuse F403 with a 7.5 amp non slow-blow fuse (Motorola Part No. 65K86099).

(10) Replace fuse F401 with a 35 amp. non slow-blow fuse (Motorola Part No. 65B83578C01 or 65B83579C01 fuse and 43A831204 fuseholder adapter).

(11) Replace fuse F402 with a 6-1/4 amp non slow-blow fuse (Motorola Part No. 65B475247).

DASH MOUNT CONTROL HEADS

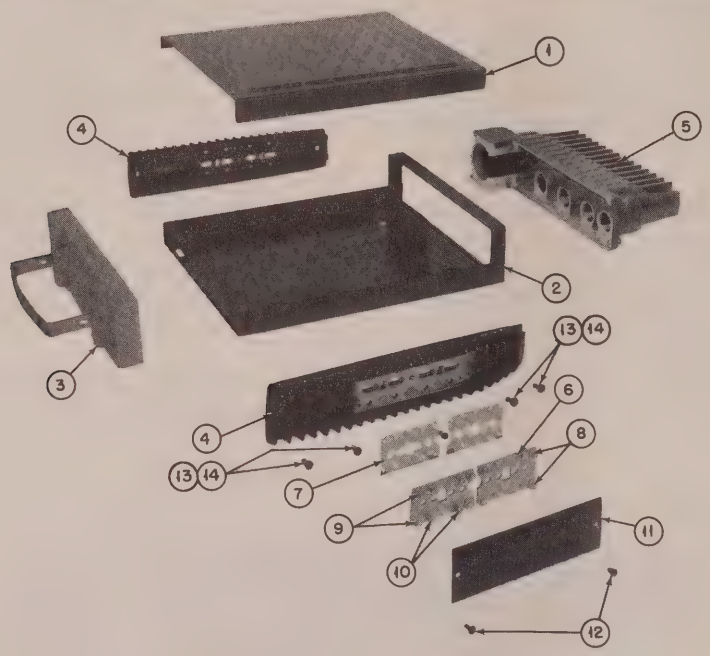
CONTROL HEAD MODEL NO.	VOLTAGE CONVERSION		RADIO SET APPLICATION		MODIFICATION PROCEDURE NO.
	From	To	FREQ.	SQUELCH OPERATION	
TCN6027AE	6	12	1	Carrier	1, 2, 3, 4, 5
TCN6027AF	6	12	2	Carrier	
TCN6027AG	6	12	1	Dual	
TCN6027AH	6	12	2	Dual	
TCN6027AE-1	6	12	1	Carrier	1, 3, 4, 5, 6
TCN6027AF-1	6	12	2	Carrier	
TCN6027AG-1	6	12	1	Dual	
TCN6027AH-1	6	12	2	Dual	

TRUNK MOUNT CONTROL HEADS

CONTROL HEAD MODEL NO.	VOLTAGE CONVERSION		RADIO SET APPLICATION		MODIFICATION PROCEDURE NO.
	From	To	FREQ.	SQUELCH OPERATION	
TCN6030AE	6	12	1	Carrier	2, 7
TCN6030AF	6	12	2	Carrier	
TCN6030AG	6	12	1	Dual	
TCN6030AH	6	12	2	Dual	
TCN6030AE-1	6	12	1	Carrier	7
TCN6030AF-1	6	12	2	Carrier	
TCN6030AG-1	6	12	1	Dual	
TCN6030AH-1	6	12	2	Dual	

TRUNK INSTALLATION CABLE KITS

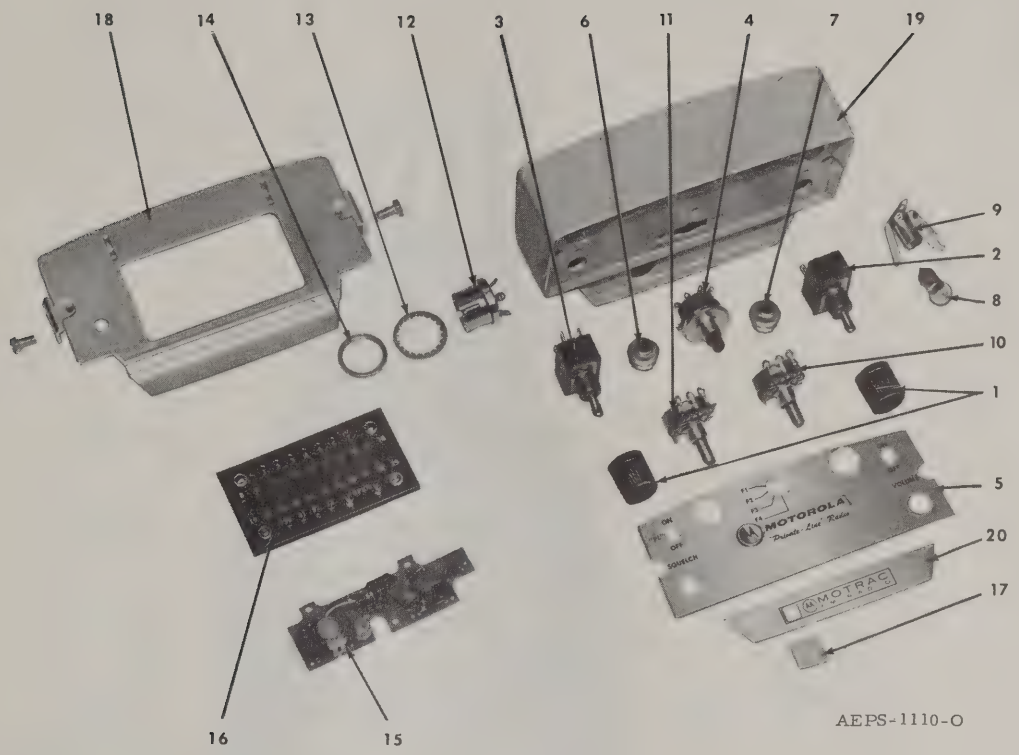
CONTROL HEAD MODEL NO.	VOLTAGE CONVERSION		RADIO SET APPLICATION		MODIFICATION PROCEDURE NO.
	From	To	FREQ.	SQUELCH OPERATION	
TKN6057A	6	12	1	Dual or Carrier	8, 9, 10
TKN6057A-1	6	12	1	Dual or Carrier	6, 8, 9, 10, 11
TKN6058A	6	12	2	Dual or Carrier	8, 9, 10
TKN6058A-1	6	12	2	Dual or Carrier	6, 8, 9, 10, 11



PARTS LIST (EPD-8221-O)

CODE	DESCRIPTION	PART NUMBER
1	Top cover (housing)	15C852668
2	Bottom cover (housing)	15D852664
3	Front Panel Assembly	TGN6002A
4	Power supply radiator	15D82215A01
5	Transmitter Radiator Assembly	1V80722A39
6	Transistor mounting plate	64A82344A01
7	Mica insulator	14A82343A01
8	Plastic shoulder washer	4A82345A01
9	Lockscrew: 6-32 x 3/8"	3S131281
10	Lockscrew: 6-32 x 5/16"	3S122318
11	Heat sink cover	15D82215A05
12	Screw: 6-32 x 3/8" "Phillips"	3S131440
13	Screw: 10-32 x 1/2"	3S131269
14	Lockwasher: #10 split	4S2613

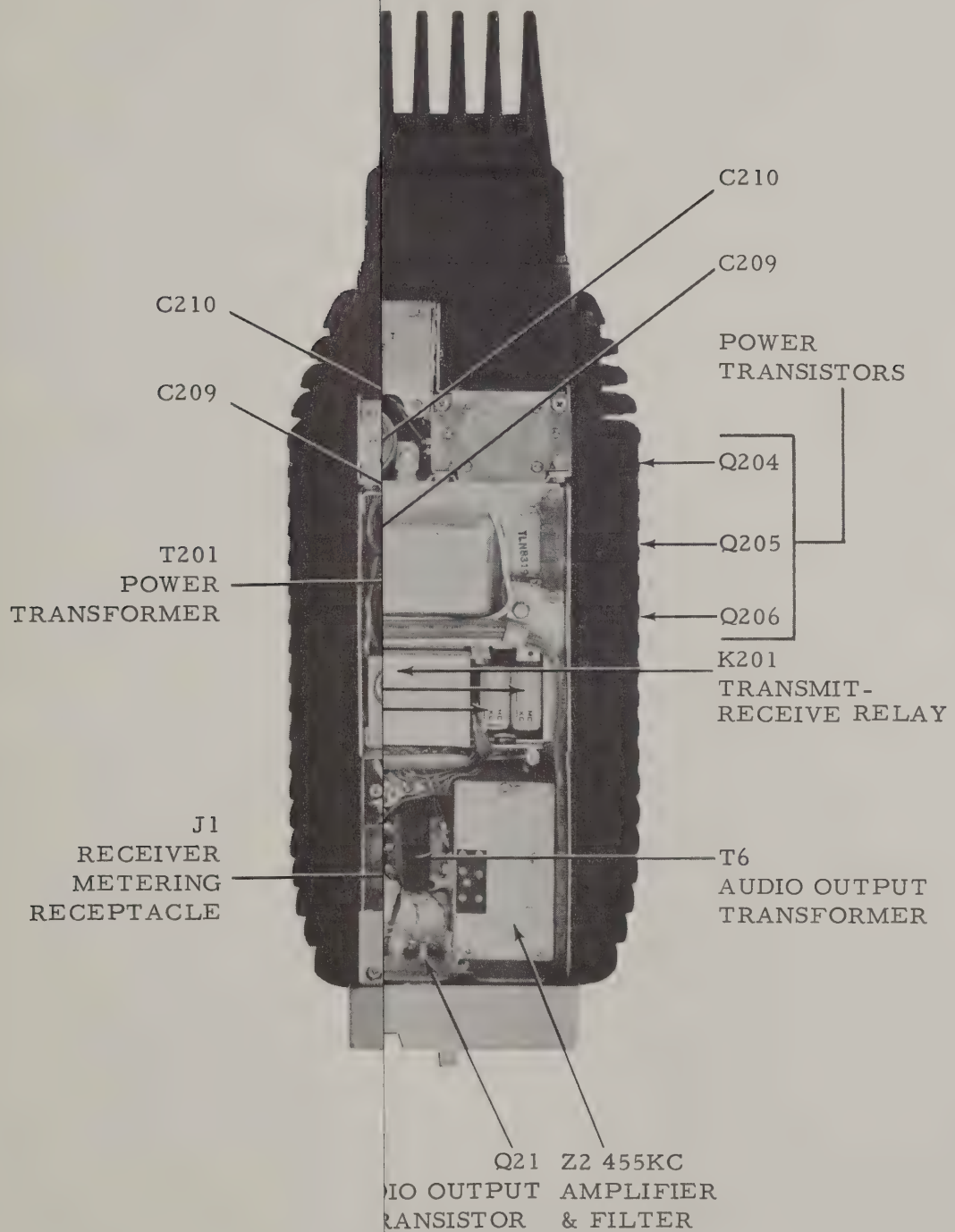
Figure 13. Heat Sink and Housing Detail and Parts List



PL-295-O

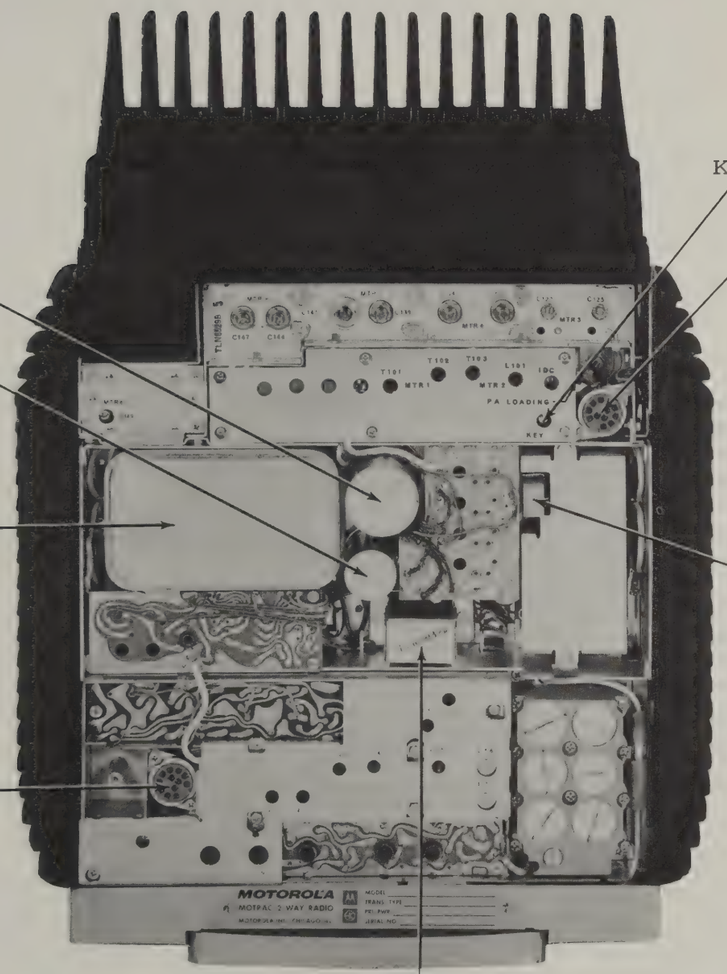
CODE	MOTOROLA PART NO.	DESCRIPTION
1	36B82869D01	Knob (Frequency Select; 4-freq. models only)
	36K858652	Knob (VOLUME; SQUELCH)
2	40A80246	Switch, Toggle (F1-F2) (2-freq. models only)
3	40K80247	Switch, Toggle (ON-OFF)
4	40C83624D01	Switch, Rotary (Frequency Select)
5	13D857971	Escutcheon - 1F Carrier Squelch
	13K857972	Escutcheon - 2F Carrier Squelch
	13D82286C23	Escutcheon - 4F Carrier Squelch
	13K857975	Escutcheon - 1F "Private-Line" Tone-Coded Squelch
	13K857976	Escutcheon - 2F "Private-Line" Tone-Coded Squelch
	13D82286C22	Escutcheon - 4F "Private-Line" Tone-Coded Squelch
6	61B83678D01	Cap and Jewel (Red)
7	61B83678D02	Cap and Jewel (Green)
8	65S4151	Bulb
9	9B863168	Lampholder
10	18C857698	Potentiòmeter (VOLUME)
	18K868896	Potentiometer (VOLUME) (w/ON-OFF switch)
11	18K857840	Potentiometer (SQUELCH)
12	9K830418	Microphone Receptacle
13	4S7699	Lockwasher
14	2A482070	Retaining Nut
15	1V80700B07	Dimmer Circuit Board
16	31C83286D01	Terminal Board
17	26B83806D01	Light Shield
18	15C82401D01	Back Cover
19	15D83576D03	Housing
20	33C83646D03	Nameplate (dimmer type)
	33C83646D04	Nameplate (non-dimmer type)

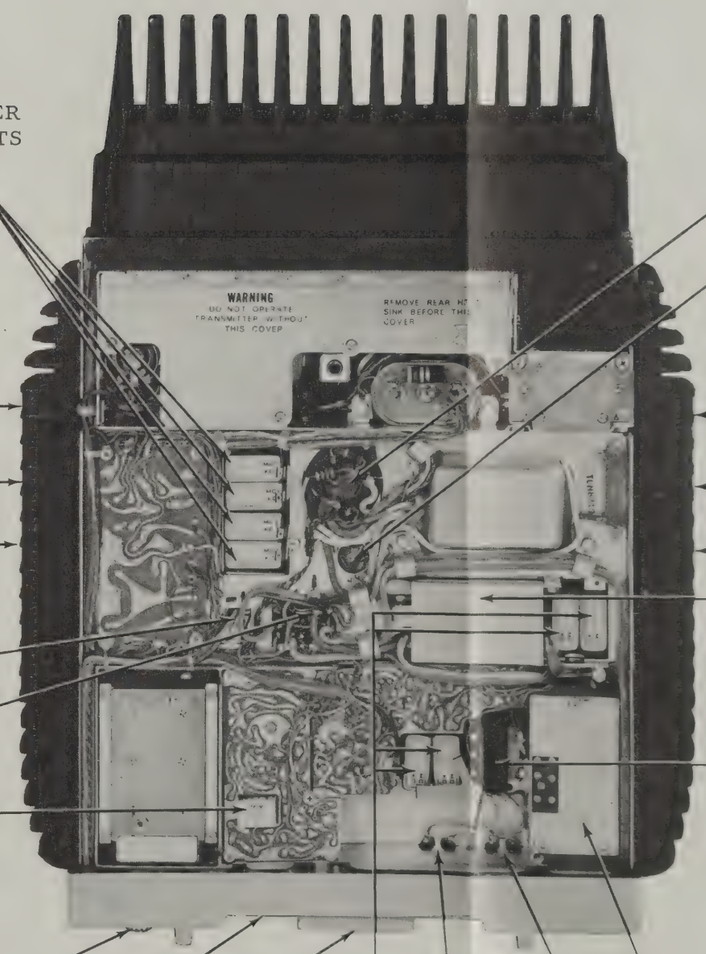
Figure 14.
Control Head Detail and Parts List


C210
C209
C210
C209
POWER
TRANSISTORS
Q204
Q205
Q206
T201
POWER
TRANSFORMER
K201
TRANSMIT-
RECEIVE RELAY
J1
RECEIVER
METERING
RECEPTACLE
T6
AUDIO OUTPUT
TRANSFORMER
Q21
IO OUTPUT
RANSISTOR
Z2 455KC
AMPLIFIER
& FILTER

TOP VIEW

BOTTOM VIEW





C210

C209

T201
POWER
TRANSFORMER

J1
RECEIVER
METERING
RECEPTACLE

NEGATIVE GROUND PLUG
(OR POSITIVE/NEGATIVE
GROUND REVERSING KIT)

KEY CONTACT

J101
TRANSMITTER
METERING
RECEPTACLE

TRANSMITTER
CHANNEL ELEMENTS

POWER
TRANSISTORS

Q203

Q202

Q201

"VIBRASENDER"
RESONANT REED

L202

J202

"VIBRASPONDER"
RESONANT REED

C210

C209

POWER
TRANSISTORS

Q204

Q205

Q206

K201
TRANSMIT-
RECEIVE RELAY

T6
AUDIO OUTPUT
TRANSFORMER

J203
ANTENNA
RECEPTACLE

K202
ANTENNA
RELAY

J201

RECEIVER
CHANNEL
ELEMENTS

Q22
AUDIO OUTPUT
TRANSISTOR

Q21

Z2 455KC
AMPLIFIER
& FILTER

REDUCTION OF INTERFERING NOISES IN MOBILE OPERATION

1. INTRODUCTION

Noise generated by the electrical system of the vehicle, as well as local ambient noise, may interfere with normal operation of two-way mobile radios. To overcome these interferences, various noise reduction procedures are required. These requirements vary from one vehicle to another, depending on the frequency of the system, the type of vehicle used, as well as the area the system is expected to cover. If the area to cover is sufficiently small so that signal levels may always be high, less noise reduction is required. Conversely, for maximum range coverage and operation into weak signal areas, noise reduction becomes very important.

Noise reduction is accomplished by proper bonding, filtering with coaxial capacitors, and miscellaneous techniques outlined in these instructions.

Before attempting any noise reduction procedures determine the noise source, then follow a systematic method of elimination until the interference is removed, or appreciably reduced.

2. NOISE REDUCTION KITS

a. TLN8845A RF Noise Reduction Kit

This kit is for use in vehicles equipped with two-way radios and alternator type electrical systems. It is supplied with all Motorola 25-54 MHz radio sets because the noise problem is more severe in the 25-54 MHz band than it is at higher frequencies. However, this kit may be obtained as an accessory item for other radio sets if desired.

b. TLN6252A RF Noise Reduction Kit

This kit is for use in vehicles equipped with generator type electrical systems. It is not supplied but can be ordered through the nearest Motorola Parts Depot.

3. GENERAL INFORMATION

Split-channel commercial two-way equipment will communicate as far as wide band equipment under no-noise conditions, but it is more susceptible to impulse noise interference. The useful range of split-channel two-way radio communications equipment can be seriously affected by noise interference, which prevents the reception of a clear easily understandable signal. A certain amount of noise interference may be tolerated when operating in a strong signal area or when operating a short-distance from the station. However, in weak signal areas such as fringe area operation, serious noise interference can cause a complete failure in the reception of the station signal.

4. RADIO FREQUENCY BANDS

The noise problem is generally more severe in the lower frequency communications band (25-54 MHz) but can also be troublesome in the 144-174 MHz bands and higher. However, ignition noise is seldom a problem above 450 MHz. Impulse noise is most noticeable in installations of narrow bandwidth receivers. Narrow bandwidth receivers are more susceptible to impulse noises because of the steep sided selectivity characteristics and not because of the method of obtaining the selectivity.

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Issue - N

However, for greater frequency spectrum utilization, it is necessary to reduce receiver acceptance bandwidths. As these acceptance bandwidths are reduced, the noise problems become greater. Therefore, in split-channel, low band (25-54 MHz) operation, it becomes essential to include noise reduction in all mobile installations.

Noise reduction requirements will vary widely with different vehicles, types of installation and types of system operation. System use and coverage often determine how much noise reduction is necessary. If the area coverage is sufficiently small so that signal levels may always be high, less noise reduction is required. Conversely, for maximum range coverage and operation down into weak signal areas, it becomes necessary to do a very good job of reducing noise.

5. NOISE SOURCE

The source of noise can generally be determined by its sound in the speaker. For best results, in locating noise, the unit should be receiving a weak signal which produces not less than 10 db nor more than 30 db noise quieting.

Noise interference is usually traced to one of the following sources:

a. Impulse noise interference generated by the vehicle electrical system. This type of interference is generated by commutator action (on vehicles equipped with generators), vibration of electrical contacts, and electrical arcing or sparking. This broadband interference may be propagated via space radiation.

The impulse noise enters the receiver through the antenna and serious interference in the form of tuned circuit "ringing" results even though the impulse may be very brief. "Ringing" may be defined as the shock excitation of a tuned circuit caused by an impulse which extends the duration of the impulse. It is this "ringing", caused by the impulse rather than the impulse itself, which is objectionable.

b. Noise produced by fluorescent lights, electric motors, electric fences, induction from power lines and similar sources is generally AM in nature, excluding capture effect. Normally, all such noise is removed from a received carrier by effective limiting action. Also, a vehicular radio is able to move out of a high noise level area if this type of noise interferes with reception. Thus, such conditions may be tolerated.

NOTE

Noise produced in the receiver, as well as ripple in the power supply, have been taken into consideration in the original design of the equipment. Any well designed mobile radio unit will not present any serious problems in this respect.

6. IGNITION NOISE

An automobile electrical system provides the primary source of electrical interference to radio communications in mobile installations. It can be generated in the spark plugs, distributor contacts, generator armature (on vehicles so equipped), voltage regulator, electrical gauges, wheel static and any part of the car where friction may exist due to intermittent contact between any two members of the car's mechanical structure.

In a mobile installation, the prime source of electrical interference with radio communications is in most cases the result of a spark discharge or arc created in the electrical system. Whenever a spark discharge takes place through air, high frequency oscillations are generated in a range of frequencies from a few kilohertz to hundreds of megahertz. These oscillations are generally radiated, however, they may be picked up by associated wiring and transferred to other electrical wiring in the system including that of the radio installation.

The problem of suppressing all the arcing that can develop in the electrical system may be difficult. For example, in an 8 cylinder engine operated at 2000 RPM, arcing in the engine system can be at the rate of 8000 sparks per minute or 133 per second. These arcs after being extended because of ringing, can create a blanket of noise blocking out weak signals at the radio receiver and only the very strongest are able to overcome such an obstacle.

7. THE IGNITION SYSTEM

In order to effectively reduce ignition interference in a car, it is well to understand the operation of an automobile ignition system.

Ignition is necessary in a gasoline engine to ignite the gasoline vapor and the air mixture in its cylinders. The system is made up of the battery, distributor, breaker points, coil, condenser and spark plugs. The 6 or 12 volt battery is the only electrical source of power in an automobile.

Therefore, its low voltage must be stepped up to the high voltage necessary to develop an arc across the electrode of the spark plugs. This arc ignites the gas mixture.

The electrical circuit arrangement is accomplished by a mechanical circuit breaker (points in the distributor) which opens the primary circuit of the igntion coil. By transformer action in the coil, high voltage is developed at the coil secondary. This high voltage is applied and synchronized to each spark plug by means of the distributor.

As shown in Figure 1, the battery is connected to the primary winding of the coil through the ignition switch. The primary circuit is completed back to the battery through the breaker points, which are bypassed by the condenser. The points are normally closed. As the cam shaft is rotated by the engine, it lobes or corners open and close the points in proper synchronism with each cylinder.

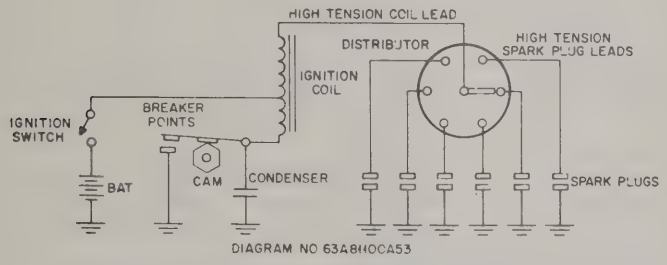

Figure 1.
Ignition Circuit

With the ignition switch on and the breaker points closed, as shown in the simplified schematic circuit in Figure 2, the primary current in the coil cannot build up rapidly, due to the self-inductance of the primary coil.

When the breaker points open, the primary current decreases almost instantly and an EMF is produced in the primary by self-induction, which is many times greater than the battery voltage. Also, when the breaker points open, the condenser reduces arcing of the points. Because of the stepped up ratio, the high voltage induced in the coil secondary causes a spark across the spark plug gap for a short interval of time.

The secondary circuit of the ingition coil, with the spark gap, is much like a spark transmitter used in the early days of radio. It is the heart of the ignition interference. All that is needed is an inductance and capacity in series with the spark gap. The lead inductance and stray capacity provides this tuned circuit. Because the discharge of the circuit is through a low resistance (ionized spark gap), the circuit tends to oscillate. The frequency of oscillation and the amplitude that is developed varies as the current changes in the spark gap. This oscillation in the high tension leads develops rf currents which can interfere with the radio reception.

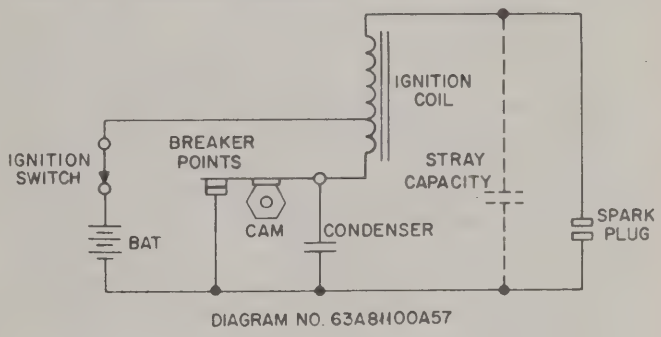

Figure 2.
Simplified Ignition Circuit

8. NOISE REDUCTION TECHNIQUE

It has long been known by ignition engineers that the addition of a series resistance adjacent to a spark discharge will serve to damp out the troublesome oscillation which causes interference. The types of spark plug suppression consistent with good engine performance to be applied in noise reduction should always be in accordance with the recommendations of the car manufacturer, i.e., if spark plugs are to be replaced with built-in suppressor types, they should be in the proper heat ranges and thread sizes for the particular engine. If resistance wire is used, the length may be critical so as not to exceed the total permissible resistance to be added. In addition to spark plug suppressors or resistance wire, an economical basic kit of noise reduction items can consist of the following: special coaxial capacitors, combinations of resistor and capacitor assemblies, and hood wiper springs.

The importance of such noise reduction items is greatly increased by their application at the right terminal points in the car's electrical system. Following is an outline of the important points to be considered and a step by step procedure in ignition noise reduction.

NOTE

Noise reduction can only be achieved if components are properly grounded. BE SURE THAT ALL CAPACITORS AND THE GENERATOR FIELD ASSEMBLY (if so equipped) ARE PROPERLY

NOTE (CONT'D)

GROUNDED. On some vehicles, standard bypass capacitors may already be installed at the locations referred to in these instructions. When these instructions call for coaxial capacitors, remove the standard bypass capacitor and mount the coaxial type per instructions.

In the development of a noise reduction kit, it was not deemed necessary to include a resistance cable in the wiring harness. One or the other of such items is generally found as a standard part of present day motor vehicles. However, the absence of such items from a basic noise kit is not to be misconstrued as being non-essential to noise reduction. Spark plug noise reduction is one of the most essential points to be covered in all cases.

a. Generator Interference (Generator-Equipped Vehicles Only)

The generator is a source of electrical interference which is frequently blamed on the ignition system. Electrical current passing between the brushes and commutator in the generator creates many small arcs as the armature rotates. Generator noise is characterized by a high pitched "whine" and varies with engine speed. A .5 uf coaxial capacitor should be placed in series with the generator armature to reduce interference.

b. Voltage Regulator Interference

The voltage regulator is a precise mechanism containing three separate control systems operating with breaker contacts. Vibrating breaker contacts cause arcing which may result in annoying interference. This interference is usually noted in the form of erratic popping in the receiver which changes only slightly in frequency with increase in engine speed.

CAUTION

Disconnect the ground battery terminal from the battery before attempting to add any components to the battery terminal of the voltage regulator. Failure to remove the battery ground connection may result in one or more blown fuses in some vehicles. Some voltage regulators have fuses as part of the regulator circuit.

To reduce voltage regulator hash noise, two .5 uf coaxial capacitors and a resistor-capacitor assembly should be used. They are part of the TLN6252A Kit (8C82571B01 Coaxial Capacitor and 1V80700A89 Generator Field Suppression Assembly) or they can be ordered separately from the Motorola Parts Department.

NOTE

These capacitors are not required in alternator equipped vehicles.

c. Ignition Coil Interference

At the ignition coil, mount the 0.1 uf coaxial capacitor as follows:

(1) Ground the capacitor with one of the mounting bolts holding the ignition coil. Choose the mounting bolt that permits the most convenient wiring (see Figure 3.)

CAUTION

When tightening the nuts on the coaxial capacitor, be sure to hold the nut closest to the capacitor body firmly with an open-end wrench to prevent possible breakage of the capacitor seal.

(2) Disconnect the wire (or wires) from the primary (low voltage) terminal, battery side, of the ignition coil and reconnect it to one end of the 0.1 uf coaxial capacitor.

(3) Use the 5-inch lead with identical lugs on each end to connect between the other end of the capacitor and the primary (low voltage) terminal of the ignition coil.

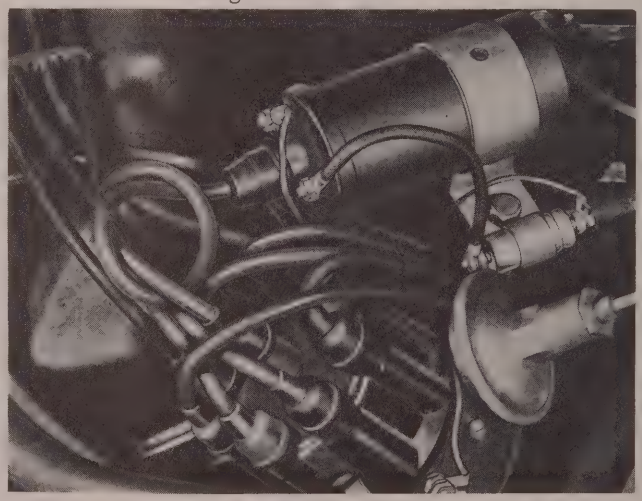

Figure 3.

IMPORTANT

Ordinary bypass capacitors should not be used in place of coaxial capacitors. The ordinary bypass capacitor displays a resonance effect with high rf noise attenuation, at about 2 megahertz. The coaxial type is non-inductive and provides high attenuation of rf noise up into the uhf region.

d. Distributor Interference

Sparking in the distributor itself is a source of radio interference. As the rotor rotates in the cap, sparking occurs between the rotor and the distributor cap inserts. To reduce the interference, a length of radio ignition wire connecting the ignition coil to the distributor cap has proven most effective. (See Figure 4.)

NOTE

If the vehicle is already equipped with radio ignition wire, the procedures of this paragraph are not necessary.

(1) Remove the ignition cable connecting the high voltage (secondary) terminal of the ignition coil to the distributor cap.

(2) Replace this lead with the suppressor cable supplied. If necessary take up the slack by tying an overhand knot in this cable.

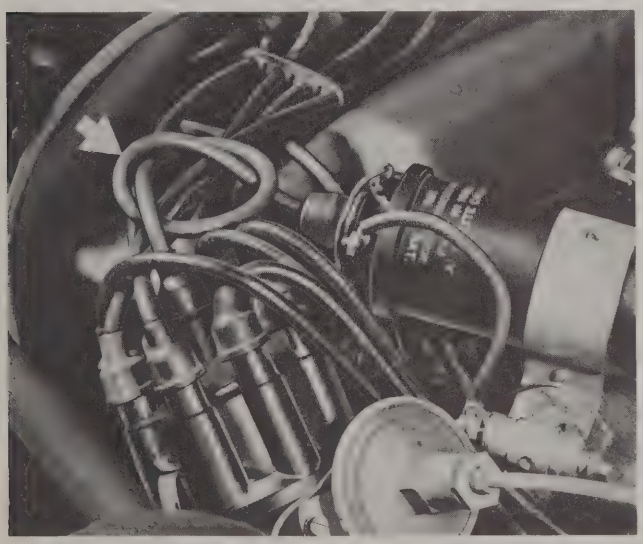

Figure 4.

e. Battery Connection

Connecting the radio primary power lead directly to the battery instead of the starter relay can help to keep noise off the "A" lead. The battery acts as a large capacitor (about 1 farad for 50 amp capacity batteries) bypassing noise to ground. This large capacitor serves as a very effective bypass. The battery ground return should also be bonded to the frame. Utilizing the car frame as a common ground as much as practical, tends to minimize the possibility of inducing undesirable parallel ground currents.

f. Hood Wipers

The ground returns for the electrical circuits are provided through the body and frame of the automobile. Differences in conductivity, inadequate bonds between adjacent conductors and unequal current distributions result in potential differences throughout the vehicle. The miniature arcs created by these potential differences can be avoided by eliminating the potential differences. Effective use of copper bonding braid and brass contact wipers as hood bonds will minimize interference from this source.

For installation of the two hood wipers, proceed as follows:

(1) Mount the two hood wipers on the surface where the hood closes at the firewall. (See Figure 5.)

(2) Remove all paint from the body and hood surfaces where electrical contact is to be made.

(3) Fasten with the two #8 self-tapping screws provided. (A #31 drill is recommended.)

(4) Bend the wipers by hand so that they make firm contact with the paint-free surface of the hood when the hood is closed.

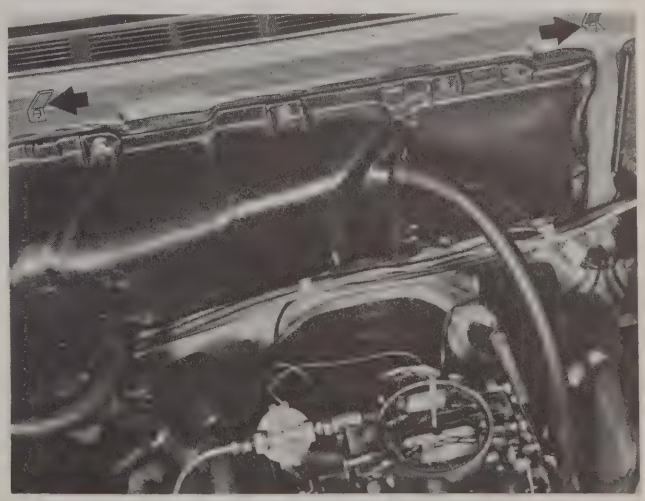

Figure 5.

g. Tagging Leads

A DO NOT REMOVE tag is included in the kit to alert the mechanics or technicians, not familiar with communications equipment, that a certain noise reduction component is essential for proper operation of two-way radio equipment.

Add the tag to the lead between the coaxial capacitor and ignition coil.

9. NOISE BALANCING IN RECEIVERS

Noise balancing a receiver may result in an appreciable amount of noise reduction. However, this method alone may not reduce all the apparent ignition noise.

It is characteristic of an FM receiver, that at one point in the alignment, a null point in impulse noise response will be reached. This null may vary from installation to installation. As the unit leaves the factory, the receiver is tuned to the exact operating frequency and is properly adjusted for proper noise balance. However, if it is found necessary to noise balance the receiver at some future date (as the set ages) or in some specific installation, the following procedure should be used:

Adjustments should be made with the receiver installed in the mobile vehicle and the vehicle engine running.

a. Turn the equipment "on" and allow it to warm-up for at least five minutes.

b. Turn up the volume to a normal listening level.

c. Radiate a signal on the frequency of the receiver. The signal can originate from a Motorola portable test set with a built-in crystal controlled peaking generator and correct channel crystal, from a signal generator, or from a distant transmitter.

The receiver should be on frequency. The receiver signal should be just strong enough to produce 10 to 30 db quieting.

d. Start the vehicle and let the engine idle.

e. Connect the portable test set to the receiver metering receptacle.

f. Place the selector switch of the test set in position 2.

g. Adjust any one of the first i-f coils until ignition noise is substantially reduced. The first i-f coils are very sensitive and may only be adjusted a very slight amount without reducing receiver gain. When making ignition noise balance adjustments, do not decrease the meter reading more than one-half microampere.

h. If satisfactory reduction of audible noise cannot be obtained by the methods previously described, the secondary winding of the discriminator is probably not aligned to exactly 455kHz. Align the discriminator as described in the receiver alignment procedures of the instruction manual.

10. ADDITIONAL NOISE REDUCTION TECHNIQUES

In some radio installations it may be necessary to obtain maximum noise reduction. In such installations, the following possible source of noise interference should be explored and the remedy applied.

NOTE

Add DO NOT REMOVE tags to all additional components if installed.

a. Ammeter to battery lead. (Bypass with .5 uf capacitor. Motorola Part No. 8A821889.)

b. Gauges, oil signal, gasoline and temperature. (Bypass with .5 uf capacitor. Motorola Part No. 8A821889.)

c. Ignition switch. (Bypass with .5 uf capacitor Motorola Part No. 8A821889.)

d. Headlight, tail light or dome light leads. (Bypass with .5 uf capacitor. Motorola Part No. 8A821889.)

e. Accessory wiring, electrical windshield wipers, heater motor, window openers and others. (Bypass with .5 uf capacitor. Motorola Part No. 8A821889.)

f. Wheel static. (Use wheel static collector rings on both front wheels.)

g. Acute cases of generator noise (in vehicles so equipped). (Install a .5 uf coaxial capacitor in series with the armature lead. Motorola Part No. 8C82571B01.)

h. For severe cases of ignition interference, Hallett Ignition Shielding Kits are available from

Motorola on separate order. These special shielded harnesses are available for most automobile and truck engines, providing improve communication in fringe areas and essentially waterproofing the ignition system. Supply the following information when ordering Hallett Ignition Shielding Kits:

1. Make and year of vehicle.
2. Auto or truck and number of cylinders.
3. Engine cubic inch displacement.
4. Type of ignition system; Auto-Lite, Crysler, etc.

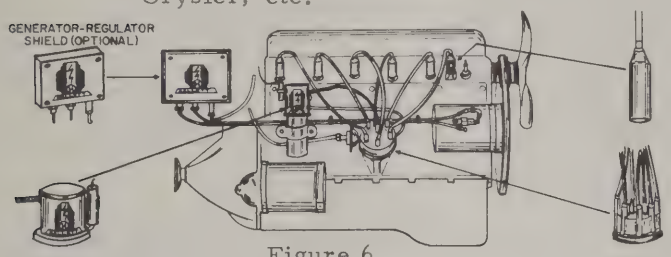

Figure 6.
Ignition Shielding Kit

NOTE

Fire truck engine shielding requires more detailed information to assist in supplying the proper kit. Write first for the special "fire truck shielding form" from your nearest Motorola Parts Depot.

11. CONCLUSION

The level to which ignition noise interference will need to be reduced will depend on the environmental conditions of operation of the radio system. The factors involved are the strength of the received carrier at various points within range of the fixed station, and the clarity of signals at the fringe areas. However, in most cases ignition noise interference can be substantially reduced resulting in optimum performance of the radio equipment under most operating conditions.

The reduction of ignition noise interference, in many cases, is essential to good system performance. Therefore, it must be given full consideration in the initial installation of the radio equipment. The components required to successfully reduce ignition noise interference may well prove to be an essential part of the communications system. Indeed, no installation of mobile radio can be complete unless the remedy for bothersome ignition noise interference has been successfully applied at the time of installation.

Specific noise sources may be isolated to some extent, under specific conditions. When the vehicle is standing still with the ignition switch off, any noise heard will probably be external to the vehicle. Static discharge noise will be added when the vehicle is moving with the ignition switch off. If the vehicle is coasting in gear, with the ignition switch off, generator noise will be added to the others, if present. Noise produced by inadequate bonding will be most noticeable when maximum current is being drawn from the battery, and may be increased when the vehicle is in motion. Care should be used to be sure that noise tests are made both with and without weak signals. Also, care should be used to check with the squelch control in the unsquelched or maximum sensitivity condition.

The use of a coaxial flexible lead, with a probe pick up loop of about one inch diameter, connected to a separate powered radio set or oscilloscope and utilized as a search wand to find the hottest areas, has been found to be most useful.

It is impossible to give an exact procedure to counteract noise in all cases; too many variables exist. With an understanding of some of the sources of noise, an intelligent approach will often save considerable time. Ignition noise reduction can add to both operational efficiency and operator satisfaction.

NOISE IDENTIFICATION AND REDUCTION CHART

Characteristics of Noise at Speaker	Source of Noise	How to Check Source of Noise	How to Reduce Noise
Identified as popping sound	Ignition	Noise varies in frequency with engine speed and will disappear when ignition is switched off.	1. Check to be sure: (a) Distributor breaker points are in good condition. (b) Ignition capacitor is in good condition. (c) All ignition system connections are free of corrosion & making good contact. (d) There is dc continuity in high voltage leads. (e) There are sufficiently high spark plug breakdown voltages. (f) Spark plug electrodes are properly spaced and in good condition. 2. Bond each corner of the motor block to chassis ground using a heavy copper grounding braid. 3. Damp the high voltage by installing a resistor suppressor in the distributor rotor lead, or suppressors in the ignition cables or on top of the spark plugs. 4. Install resistor spark plugs or resistance ignition cables.
Identified as a high pitched whine	Generator	Noise varies with engine speed and will persist if ignition is switched off while engine is running at a moderate speed.	Install a .5 uf coaxial capacitor at the generator in series with the armature lead.

NOISE IDENTIFICATION AND REDUCTION CHART (Cont'd)

Characteristics of Noise at Speaker	Source of Noise	How to Check Source of Noise	How to Reduce Noise
Identified as raspy sound	Voltage Regulator	Look for arcing voltage regulator contacts.	Install .5 uf coaxial capacitors, Motorola Part Number 8A821889 at the battery (BAT.) terminal in series with the battery lead and at the generator (ARM) terminal in series with the armature lead. Install RC Filter (1V80700A89) composed of a 3.3 ohm resistor in series with a .002 uf capacitor (Maximum allowable capacity) in series with the field (F) terminal of the voltage regulator to a common ground.
Identified as a hissing or crackling sound	Gauges	Noise may be detected by jarring the individual gauges while the ignition is on.	Install .5 uf bypass capacitors where needed. (Motorola part #8A821889)
Identified as a low-pitch clicking sound	Oil Sender	Noise rate varies with oil pressure and stabilizes at point of maximum oil pressure.	Install .5 uf bypass capacitor (Motorola Part Number 8A821889) from gauge lead terminal on Oil Sender to chassis ground.
Identified as an irregular popping sound	Wheel Static	Noise disappears when brakes are lightly applied.	Install suitable grounding brushes or springs such as front wheel static eliminators (Motorola Part Number 1K534254 regular type, 1K563174 small type).
Identified as a more regular or sharper popping sound	Tire Static	Noise becomes much worse at 30-50 mph.	Use anti-static powder in tires with inner tube.

12. KIT COMPLEMENT

a. TLN6252A Noise Reduction Kit

Reference Number	Quantity	Motorola Part Number	Description
1	3	1V839913	Lead & Lug Assembly
2	1	1V80700A88	Lead & Lug Assembly
3	1	8C82571B02	Capacitor, Coaxial (.1 uf - 100 V)
4	3	8C82571B01	Capacitor, Coaxial (.5 uf - 100 V)
5	1	1V80700A89	Generator Field Suppressor Assembly
6	1	30A502396	Ignition Coil Suppressor Cable
7		1V80700A91	Hood Wipers and Mounting Kit Hardware

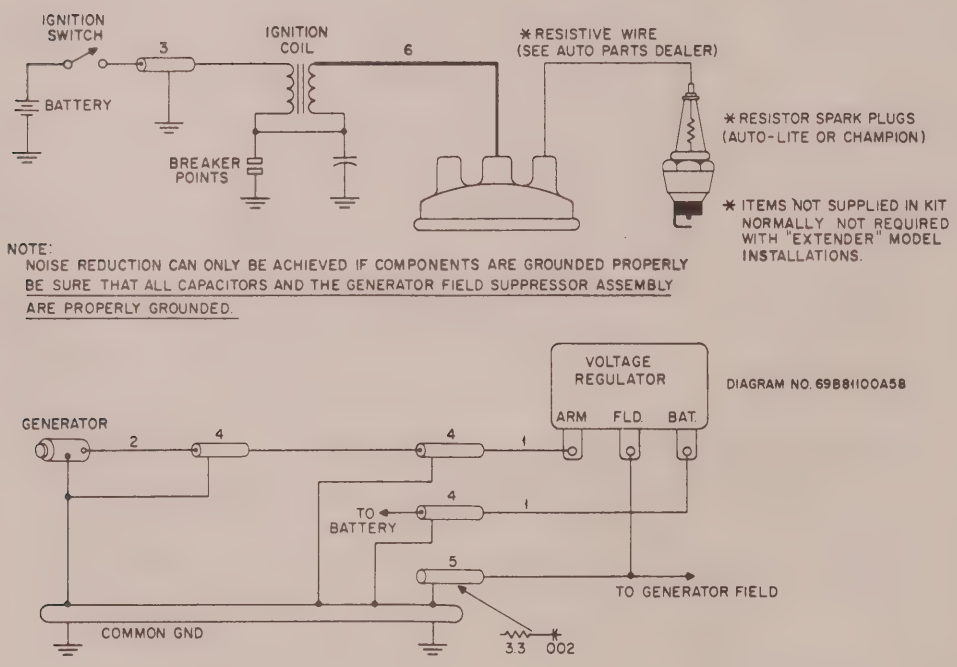

Figure 7.
Typical Noise Reduction Detail Using
TLN6252A Noise Reduction Kit

b. TLN8845A Noise Reduction Kit

Quantity	Motorola Part Number	Description
1	1V839913	Lead & Lug Assembly
1	8C82571B02	Capacitor, Coaxial (.1 uf, 100 v)
1	30A502396	Ignition Coil Suppressor Cable
1	1V80782A52	Hood Wipers and Mounting Hardware Kit

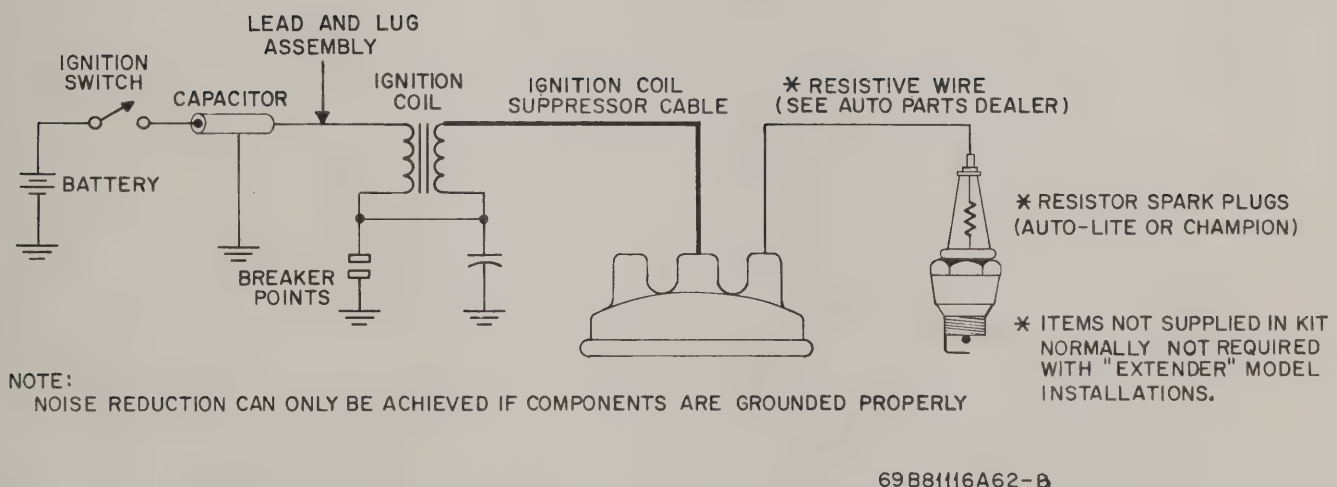
LEAD AND LUG ASSEMBLY
IGNITION SWITCH
CAPACITOR
IGNITION COIL
IGNITION COIL SUPPRESSOR CABLE
* RESISTIVE WIRE (SEE AUTO PARTS DEALER)
BATTERY
BREAKER POINTS
* RESISTOR SPARK PLUGS (AUTO-LITE OR CHAMPION)
* ITEMS NOT SUPPLIED IN KIT NORMALLY NOT REQUIRED WITH "EXTENDER" MODEL INSTALLATIONS.
NOTE:
NOISE REDUCTION CAN ONLY BE ACHIEVED IF COMPONENTS ARE GROUNDED PROPERLY
69B81116A62-B

Figure 8.
Typical Noise Reduction Detail Using
TLN8845A Noise Reduction Kit

MOTOROLA

"MOTRAC"® "MOTRAN"® AND TRUNK-MOUNT
"MOCOM • 30" SERIES MOBILE RADIO SETS
12-VOLT SYSTEMS

INSTALLATION AND OPERATION

PRE-INSTALLATION INSTRUCTIONS

CAUTION

Before installation, check the polarity of your vehicle ground. Refer to the accompanying instruction manual and diagrams for instructions regarding negative or positive ground operation.

1. UNPACKING

a. "Motrac" & "Motran" Series Radio Sets

The shipping carton is divided into two sections by a lift-out shelf. With the exception of the antenna rod, all of the accessories are packed in the upper section. The lower section contains the radio set. With 136-174 mc, 406-420 mc and 450-470 mc radio sets, the antenna is packed in the lower section. It is contained in a corrugated box which serves as a spacer. With 25-54 mc radios, the antenna rod is shipped in a separate carton. Separate installation instructions for the speaker, mounting brackets, and antenna are packed with the accessories.

b. "Mocom • 30" Radio Sets

The shipping carton is divided into two levels by a lift-out shelf. With the exception of the antenna, hardware, and cable kit, all of the accessories are packed in the upper section. The lower section includes the radio set, cables and mounting hardware. Separate installation instructions for the speaker, mounting brackets, and antenna are packed with the accessories.

Save all instruction sheets for installation reference and maintenance. Inform the transportation company immediately if any items have been damaged in transit.

2. SHIPMENT CHECKING

A packing slip (factory order) will be found in one of the cartons which is labelled: PACKING SLIP ENCLOSED. The slip lists the contents of the shipment. One instruction manual is supplied with every five radio sets. Cartons which contain manuals are labelled: INSTRUCTION MANUAL. Refer to the manual and packing slip when checking the shipment.

The instruction manual includes a RADIO SET MODEL CHART and an ACCESSORY GROUP CHART. From the factory order, determine the model number of the radio set(s). Find this model number in the MODEL CHART and mark the items included with this model. Find the accessory group and mark the items included with the radio set in the ACCESSORY GROUP CHART. Use these charts for checking the shipment.

3. OPERATIONAL CHECK

If the equipment is to be stored for some time before installation, an operational check should be made at once. The purpose of this check is to make sure that the radio set is in proper working order as received from the factory. To make this check follow the instructions given under PRE-OPERATIONAL INSTRUCTIONS. Should the check indicate satisfactory performance, the equipment may be stored for future installation.

If the equipment is to be installed at once, the operation check can be made after the installation is complete. Before placing the equipment in service follow the PRE-OPERATIONAL INSTRUCTIONS.

MOTOROLA INC. **Communications Division**
ENGINEERING PUBLICATIONS 1301 W. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172

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PRE-OPERATIONAL INSTRUCTIONS

CHECKS AND ADJUSTMENTS

a. Purpose

Although the equipment has been accurately aligned at the factory, it is possible that mishandling in transit may have disturbed some of the adjustments. It is essential, therefore, that a pre-operational check be made when the equipment is installed to assure proper operation.

b. Housing Removal

To remove the housing from the radio set as it is received from the factory, proceed as follows:

(1) Remove the keys that are taped to the handle on the front of the radio set. Unlock the radio set by turning the key clockwise 1/4 turn.

(2) Place the radio set so that it is standing on the rear heat sink as illustrated.

(3) Grasp the radio set as shown in the photograph. The thumbs should be on the angled portion of the embosses (formed protrusions).

Figure 1
Typical Housing Removal

(4) Pull the housing down, apply most of the pressure at the thumbs. Remove the drawer assembly from the housing.

c. Pre-Installation Bench Check

The radio set can be checked before installation using a bench test set-up with permanently installed cabling and control facilities and a battery or battery eliminator. An antenna dummy load, r-f wattmeter or operational antenna must be connected to the radio set ANTENNA connector on the front panel. A test set for metering the transmitter and receiver should be available. This type of laboratory set-up is particularly useful where many sets must be checked. A test of this nature, however, does not give a complete check of the actual cables, control unit, and speaker to be used.

The ideal set-up for a pre-installation check is a bench test in which the radio set, cable kit control head, speaker and antenna are assembled to form a complete facsimile of the vehicular installation. The pictorial cabling diagrams in these instructions show proper component interconnection.

CAUTION

Control heads with automatic pilot light dimmer circuits are wired for use in negative ground electrical systems only. DO NOT INSTALL IN POSITIVE GROUND SYSTEMS.

When the test set-up has been assembled, the equipment can be turned on and operated as described in the following paragraphs.

d. Installation Checks

Before placing this radio set in operation, make the following installation checks:

(1) General

Be sure all cable and bolted connections are secure, all fuses are in place, and all tubes are firmly seated.

NOTE

The "Motran" Series radio sets are fully transistorized, and do not contain tubes.

To gain access to tubes located within the rear heat sink, remove the retaining screw from each corner of the housing. Then gently pull the heat sink away from the rest of the radio set.

(2) DC Input

(a) Set the ON-OFF toggle switch to the ON position or turn the OFF-VOLUME control clockwise until a click is heard. This applies the d-c voltage to the radio set.

(b) The green pilot lamp should be on indicating the A+ has been applied to the receiver. On control heads equipped with the automatic pilot light dimmer circuit, the lamp should dim when the opening for the light sensor (located on lower part of control head) is covered and brighten when the covering is removed. When the push-to-talk switch is actuated, the red lamp should light. Both lamps should dim when the light sensor opening is covered and brighten when the covering is removed.

(3) Check Receiver

(a) Meter Readings

Check receiver meter readings against the receiver stage measurement chart in the instruction manual supplied with the radio set (noise input readings only). Use the Motorola portable test set or an equivalent 0-50 microampere test meter with a series input resistance of 20,000 ohms. An adapter cable connects the portable test set to the metering socket of the receiver chassis. Check meter readings in the various test positions as indicated on the chart. If any of the readings are below the given limits, realign the receiver as described in the alignment procedure contained in the instruction manual.

(b) Check for Normal Operation

With the receiver properly aligned, the d-c input applied to the equipment, and the antenna connected, the receiver should be in full operation. Check for proper operation as follows:

DUAL SQUELCH RADIO SETS

Turn the "PL" ON-OFF switch to the OFF position, turn the VOLUME control fully clockwise and the SQUELCH control fully counterclockwise. Either a load rushing noise in the speaker or signals from any transmitting on-frequency station should be heard. In the absence of any received signals the loud rushing noise is a normal indication of receiver operation with the "PL" switch OFF and squelch control "open". Now, set the "PL" switch to ON. The speaker should become quiet and remain silent until signals are picked up from a "Private-Line" transmitter of your radio network.

(c) To Set the VOLUME Control

With the "PL" ON-OFF switch in the ON position and a signal being received from a fully deviated "Private-Line" transmitter, set the VOLUME control on the control head to the desired listening level.

(d) To Set the SQUELCH Control

1. Set the "PL" ON-OFF switch to OFF position. This sets the receiver for receiving all on-frequency signals within normal operating range.

2. Turn SQUELCH control to full counterclockwise position. In the absence of transmitted signals, a loud rushing noise can be heard from the speaker. If intelligence is being received, wait until the transmitting station goes off the air before proceeding.

3. Turn the SQUELCH control slowly clockwise, until the noise just cuts out. This adjusts the control for maximum noise squelch sensitivity. Turning the SQUELCH control beyond this point will increase the minimum signal required to open the squelch circuit.

CARRIER SQUELCH RADIO SETS

Turn the VOLUME control to the full clockwise position. Turn the SQUELCH control to the full counterclockwise position (open). Either a loud rushing noise in the speaker or signals from any transmitting on-frequency station should be heard. In the absence of any received signals, the loud rushing noise is a normal indication of receiver operation with "open" squelch.

(e) To Set the VOLUME Control

With a fully deviated signal being received, set the VOLUME control on the control head to the desired listening level.

(f) To Set the SQUELCH Control

Turn the SQUELCH control in the clockwise direction until the noise is squelched (cuts out).

(4) FCC Regulations

The operation of the transmitter in this radio set is covered by FCC rules and regulations. Several provisions of these rules are briefly summarized in the following paragraph. For complete information, refer to the most current applicable FCC regulations.

FCC REGULATIONS EXCERPTS

(a) Transmitter frequency and deviation must be checked before a transmitter is placed in service and at least once every year thereafter. A suitable procedure shall be employed to ascertain that the transmitter is on the assigned car-

rier frequency and that the transmitter crystal actually controls the frequency of the radiation. In 25-54 mc radios, modulation deviation is limited to ±5 kc for split-channel spacing (20 kc) or ±15 kc for wide-channel spacing (40 kc). In 136-174 mc radios, modulation deviation is limited to ±5 kc for split-channel spacing (30 kc) or ±15 kc for wide-channel spacing (60 kc).

(b) The r-f power output of a transmitter shall be no more than required for satisfactory technical operation considering the area to be covered and the local conditions.

(c) Radio transmitter may be tuned or adjusted only by a person holding a 1st or 2nd class commercial radiotelephone operator's license or by personnel working directly under his immediate supervision.

(5) Check Transmitter Power Output

CAUTION

Do not key the transmitter for intervals longer than a few seconds while making these power output tests.

(a) Other than "Motran" or "Mocom • 30" Series Radio Sets

The transmitter must be checked for proper operation before the equipment can be placed in service. Connect a dummy load lamp, r-f wattmeter or the regular mobile radio set antenna to the ANTENNA receptacle on the front panel. On 25-54 mc and 136-174 mc radio sets, place the HI-LO switch located at the top of the transmitter chassis to LO position (the position in which the white dot is covered). On 406-420 mc and 450-470 mc radio sets, turn the screen potentiometer located in the power supply to minimum (fully counterclockwise). Press the microphone push-to-talk button momentarily and listen for relay operation. Both the transmit-receive relay and the antenna relay must operate. Check for indication of r-f power output. The dummy load lamp should glow or the r-f wattmeter, if used, will show the r-f power output. If the regular mobile antenna is used, the transmitter should radiate signals to receivers of other sets on the same frequency.

NOTE

If the test is satisfactory, proceed to the next step. If there is no indication of r-f output, some trouble-shooting must be done before proceeding. Refer to the theory of operation and schematic diagrams included with the instruction manual.

(b) "Motran" Series Radio Sets

The transmitter must be checked for proper operation before the equipment can be placed in service. Connect a dummy load or an r-f wattmeter to the ANTENNA receptacle on the front panel. Press the microphone push-to-talk button momentarily and check for indication of r-f power output. See NOTE in subparagraph d. (5) (a).

(c) "Mocom • 30" Radio Sets

The transmitter must be checked for proper operation before the equipment can be placed in service. Connect a dummy load lamp, r-f wattmeter or the regular mobile radio set antenna to the ANTENNA receptacle on the front panel. Press the microphone push-to-talk button momentarily and listen for relay operation. Check for indication of r-f power output. The dummy load lamp should glow or the r-f wattmeter, if used, will show the r-f power output. If the regular mobile antenna is used, the transmitter should radiate signals to receivers of other sets on the same frequency.

(d) Meter Readings

Refer to the transmitter alignment procedure in the instruction manual. On 25-54 mc and 136-174 mc radio sets, (except "Motran" and "Mocom • 30" Series sets) place the HI-LO switch in the HI position. Check the meter readings against the values given in the FINAL METER READING CHART. The transmitter must be keyed to obtain readings. To check readings, consult the chart and set the switch to a given position. Using the push-to-talk button on the microphone or XMTR ON switch of the Motorola portable test set, key the transmitter only long enough to observe the reading. Readings can be taken in any order. If the readings are below the minimum values given, re-align the transmitter as described in the alignment procedure.

(e) Frequency and Deviation Check

The FCC regulations require that frequency and deviation checks be performed before the transmitter is placed in service, even though the radio has been aligned and adjusted at the factory. The procedures are described in the instruction manual.

When the radio is installed in the vehicle, the transmitter must be loaded into the antenna as described in the transmitter alignment procedure.

OPERATOR'S INSTRUCTIONS

1. TO TURN "ON" THE EQUIPMENT

Set the ON-OFF switch to the ON position or turn the OFF-VOLUME control clockwise. The green lamp will go on to indicate the "standby" condition. The receiver is in full operation. For multi-frequency radio sets, place the frequency selector switch in the desired position.

2. TO RECEIVE

Typical Dual Squelch Control Head With "Extender" Operation

Perform the following operations on existing controls:

a. All Radio Sets

NOTE

Omit steps (1) and (5) for radio sets without "Private-Line" operation.

(1) To hear all on-frequency signals, set the "PL" ON-OFF switch to OFF.

(2) Turn the SQUELCH control to the full counterclockwise position.

(3) Turn the VOLUME control clockwise until noise is heard.

(4) With no signal being received, adjust the SQUELCH control by turning the control slowly clockwise until the noise is just squelched (cuts out).

(5) To hear "Private-Line" signals only, set the "PL" ON-OFF switch to ON.

(6) Set the VOLUME control to the desired listening level with a received signals.

b. Radio Sets with "Extender" Operation

(1) Under normal conditions, or when impulse noise is a problem, place the EXTEND-STD switch in the EXTEND position.

(2) In strong signal areas where interfering signals are a problem place the EXTEND-STD switch in the STD position.

3. TO TRANSMIT

NOTE

Since the "Motran" Series radio sets are fully transistorized, no warm up is required.

a. Dual Squelch Radio Sets

Turn "on" the radio set. Turn "on" the vehicle ignition switch. Wait approximately 45 seconds for the transmitter tubes to warm up. To conserve the battery, the engine should be running while transmitting.

Set the "PL" ON-OFF switch to OFF. Listen for signals of other stations which may be on the air. If signals are heard, wait until the air is clear before proceeding. When the channel is clear, set the "PL" ON-OFF switch to ON and pick up the microphone. Hold the microphone about one inch from the lips turned about 30° away from the face. Press the push-to-talk button. The red lamp will come on and the transmitter will go on the air. Speak slowly and clearly across the microphone in a normal or slightly louder-than-normal voice. At the end of the message, release the push-to-talk button and replace the microphone. This restores the "standby" condition.

b. Carrier Squelch Radio Sets

Turn "on" the radio set. Turn "on" the vehicle ignition switch. Wait approximately 45 seconds for the transmitter tubes to warm up. To conserve the battery, the engine should be running while transmitting.

Remove the microphone from the hang-up bracket. Hold the microphone about one inch from the lips turned about 30° away from the face. Press the push-to-talk button. The red lamps will come on and the transmitter will go on the air. Speak slowly and clearly across the microphone in a normal or slightly louder-than-normal voice. At the end of the message, release the push-to-talk button and replace the microphone. This restores the "standby" condition.

4. TO TURN "OFF' THE EQUIPMENT

Set the ON-OFF switch to OFF or turn the OFF-VOLUME control counterclockwise until a click is heard. The green lamp will go off.

INSTALLATION INSTRUCTIONS

TRUNK MOUNT RADIO SETS

STEP 1.

CABLE ROUTING (Refer to Figures 2, 11 and 12)

Work from the trunk space forward. In some cars there is room above the fiberboard trunk partition to admit the cables. If this is not the case, make an opening through the partition.

Tape the pin-tip connectors into a small bundle. Pass it and the long power lead forward into the passenger space.

Remove the back seat. Pull the cables into the back seat area, under the seats and floor mats out the top of the floor mat under the dash. Where no specific channel is provided, route the cable under the floor mat along the side of the drive-shaft tunnel.

Pull the control cable pin-tip connectors to the approximate location of the control head. Route the power cable into the engine compartment through the steering column hole. If necessary make a hole elsewhere in the fire wall for this cable. The hole must be 1-1/8" in diameter to fit the supplied rubber grommet. Install the grommet.

Pull the power cable through the grommeted hole. For radio sets with a 25 ampere fuse, this cable contains an in-line fuse. For sets with a 35 ampere fuse, a separate fuse block is supplied and must be mounted in the vehicle near the battery. Mount the block as follows:

Remove the fuse from the fuse block and do not replace it until the entire installation of the radio is completed.

Select a convenient location on one of the sheet metal parts of the car for mounting the block. Using the rubber gasket as a template, mark the holes with a center punch. Using a 9/64 twist drill (.140"), drill the holes and mount the block with the two #10-16 x 3/4" sheet metal screws supplied.

The cable kit contains 2 separate wires each equipped with an in-line fuse. The orange wire is 68 inches long and the green wire is 9 feet long. Pass the pin-tip end of the green wire from the engine compartment side of the firewall, through the grommeted hole, into the dashboard area.

Do not dress the wires at this time but proceed with Step 2.

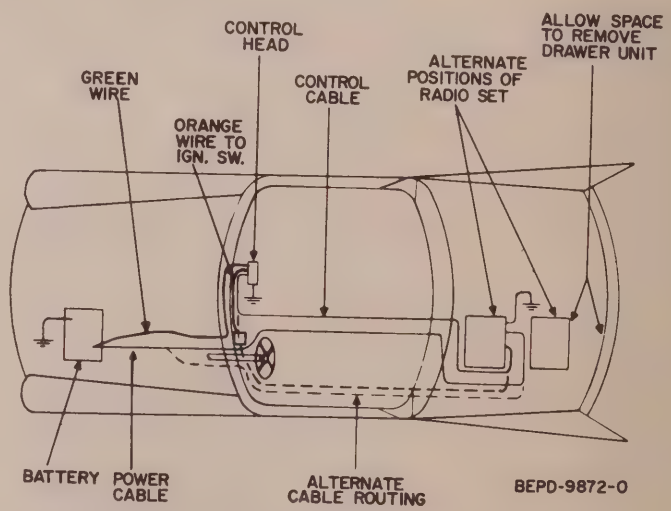


Figure 2
Typical Mobile Radio Cable Routing

INSTRUCTION MANUAL REVISION SMR-161

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

"Motrac", "Motran", and "Mocom • 30" Installation and Operation Instructions
68P81112A38-D

REVISION DETAILS

This revision contains supplementary information for dimmer control head models:

TCN6097BE	TCN6098BE	TCN6100BE	TCN6118BF
TCN6097BF	TCN6098BF	TCN6100BF	TCN6118BH
TCN6097BG	TCN6098BG	TCN6100BG	
TCN6097BH	TCN6098BH	TCN6100BH	
	TCN6098BJ	TCN6100BJ	
	TCN6098BK	TCN6100BK	

1. These control heads operate in positive or negative ground systems. The dimmer circuitry controls the intensity of the green indicator lamp, while the red indicator lamp remains at a constant illumination level.

Under high ambient light conditions, the green (receive) light intensity is greatest for highest visibility. As the ambinet light level diminishes, the lamp intensity decreases to prevent excessive glare.

The ambinet light level is sampled through an aperture on the front of the control head. Light entering the aperture acts upon a light-dependent resistor which acts with associated circuitry to control the brilliance of the lamp.

2. For these control heads, make the following changes:

a. Under Pre-Installation Bench Check, disregard the CAUTION notice.

b. After d. Installation Checks, (2) DC Input, add:

(c) The green pilot lamp should be "on", indicating that the A+ voltage has been applied to the receiver. It should dim when the light-sensor opening on the front of the control head is covered. When the covering is removed, the lamp should return to full brilliance.

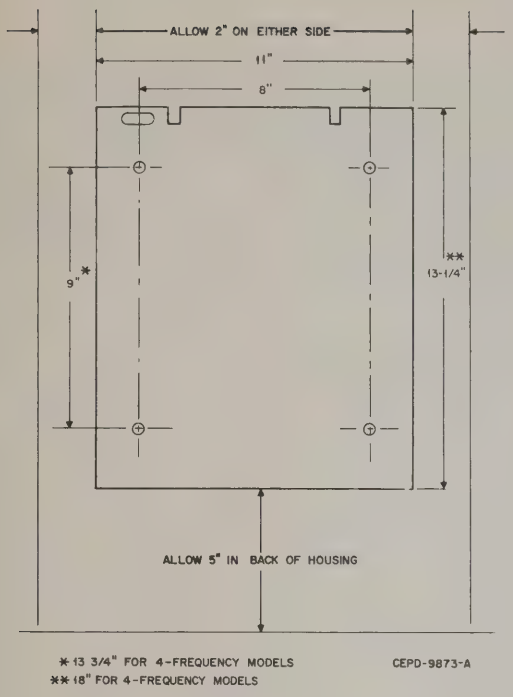


Figure 3.
Typical "Motrac" or "Motran" Housing
(Bottom View)

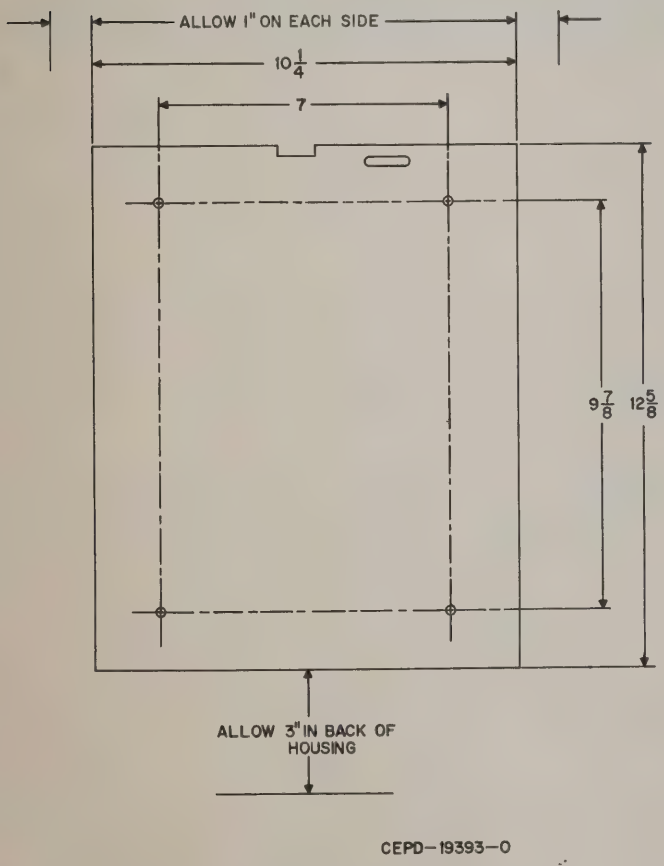


Figure 4.
"Mocom • 30" Housing (Bottom View)

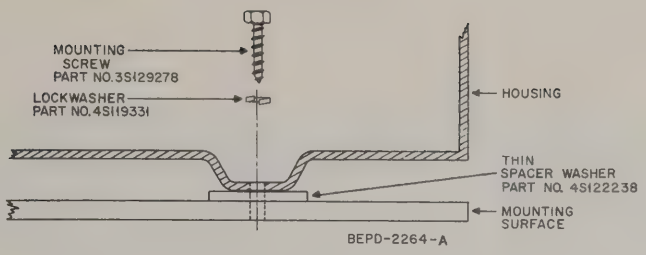


Figure 5.
Housing Installation Detail

OR

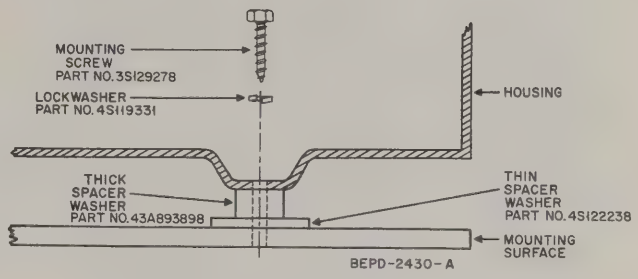


Figure 6.
Housing Installation Detail

STEP 2.

HOUSING INSTALLATION (Refer to Figures 3 or 4, 5, 6 and 7.)

Choose a location where the mounting screws are not directly above the gas tank, gas line, or other vital parts. The housing should be mounted to a level surface to prevent the bottom from becoming buckled. The raised shelf in some car trunks makes a good mounting place. Place the housing at one side to allow space for luggage. Leave at least 3 inches in front of the housing, so that the cables can be connected and the drawer assembly can be removed. The housing must be located so that the ground lead in the trunk can reach a good chassis ground point in the trunk. When the final position is determined, open the lock and remove the drawer assembly. The housing can be used as a template to mark the location for drilling the four mounting holes in the trunk floor. Use a #11 drill. Mount the housing as illustrated in figure 5 or 6.

In some vehicles the trunk floor is such that when the radio set is securely mounted, the front panel will be pressing against the floor or floor cushioning. Also, in some vehicles where it is

necessary to mount the radio set directly over the gas tank, the mounting screws may penetrate the tank (always make a preliminary check to see how long the screws will extend below the trunk floor). If either condition exists, insert one of the thick spacer washers between the bottom of the housing and the thin spacer washer, at each of the four mounting holes. The washers help to keep the radio set level, especially when the floor is covered with a "spongy" mat such as soft rubber. Replace the drawer assembly and lock the housing.

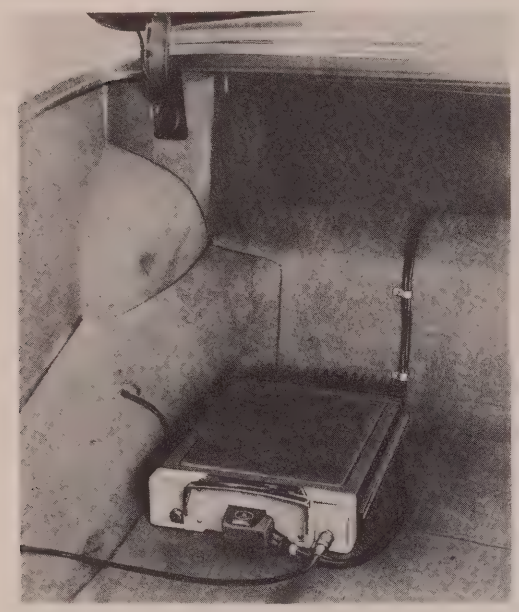


Figure 7.
Typical Trunk Installation

Connect the ground cable lug to one of the bolts under the mat on the trunk floor. Thoroughly clean the bolt and the trunk floor before bolting down the lug.

CAUTION

A good ground connection is essential to prevent damage to the cable kit in the event of a short circuit.

STEP 3.

CONTROL HEAD, MICROPHONE, AND SPEAKER INSTALLATION (See Figures 8, 9 and 10)

CONTROL HEAD --- The control head must be installed within reach of the pin-tip connectors on the control cable, previously installed. Pull more cable into the area, if necessary. Be sure that all wires are clear of the instrument panel where holes are to be drilled. Mount the bracket first, then assemble the control head to the bracket. Connect the "S" hook of the control cable clamp to one of the punched eyelets on top of the 35 pin-tip receptacle on the rear of the control head. Insert the numbered pin-tip connectors of the control cable into the corresponding numbered receptacles on the back of the control head.

At this point there is one wire which has not been used. This is the orange wire mentioned in STEP 1 with the in-line fuse and a small lug on one end and pin-tip #20 on the other end. Connect the lug end to the ignition (or accessory) terminal of the ignition switch and insert the pin-tip into #20 on the rear of the control head.

BULB REPLACEMENT --- Pilot bulbs can be replaced from the front of the control head. Merely unscrew the red or green jewel by using the fingers. Use of a tool is unnecessary and, if used, may damage the finished surface. Use a finger or the eraser end of a pencil to remove the bulb from its bayonet type base.

MICROPHONE -- The microphone bracket must be within a comfortable arm's reach of the driver. Measure this before actually mounting the bracket. Connect the microphone to the 4-pin receptacle on the control head.

SPEAKER --- Complete instructions for installing the speaker are packed with the speaker. Connect the speaker to the SPKR receptacles on the back of the control head.

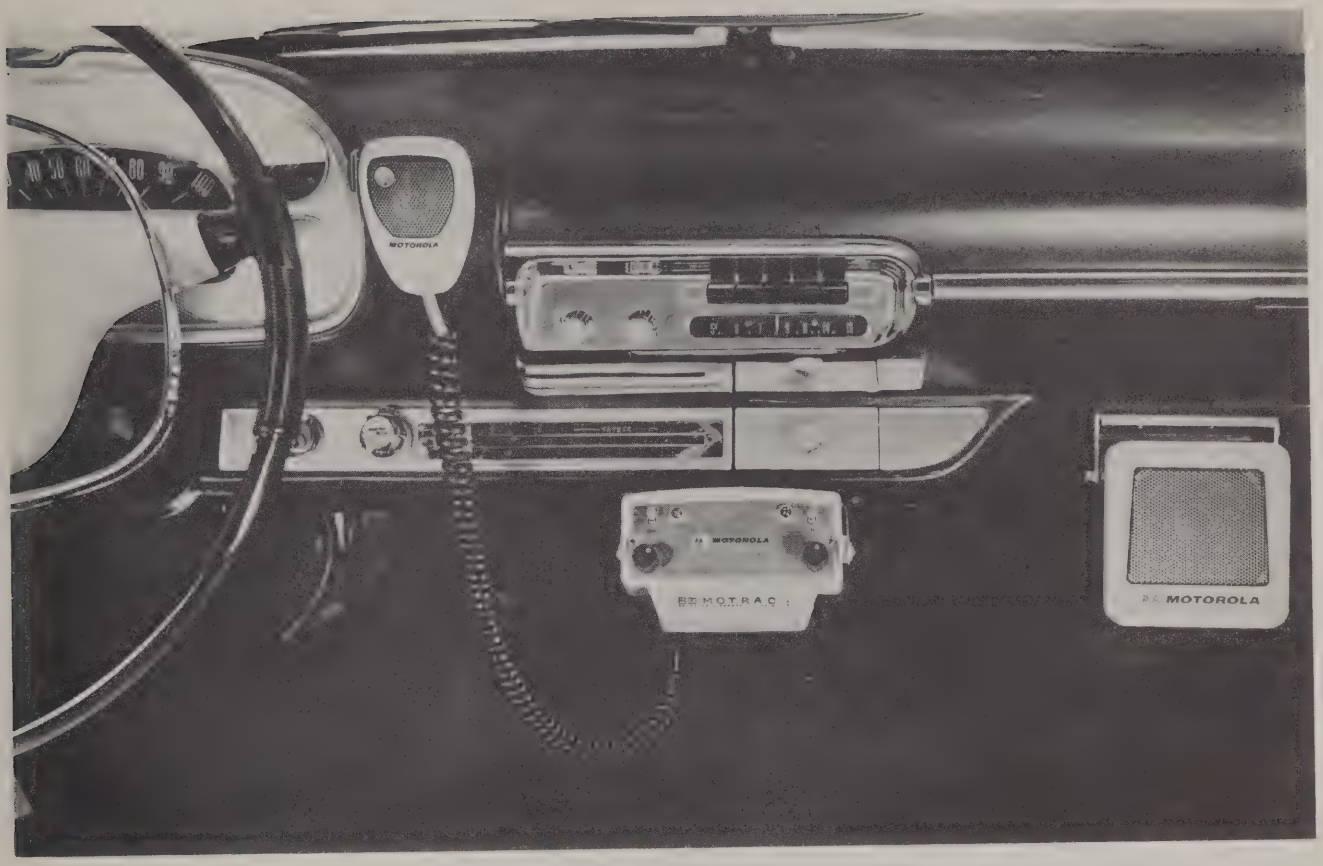


Figure 8.
Typical Installation

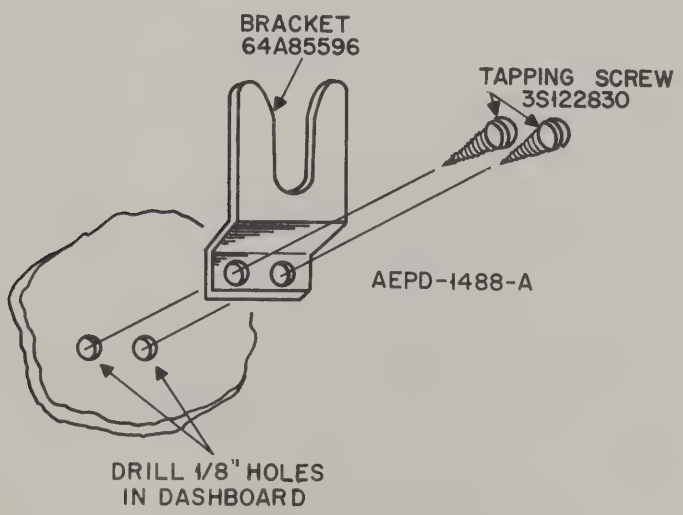


Figure 9.
Microphone Bracket Installation

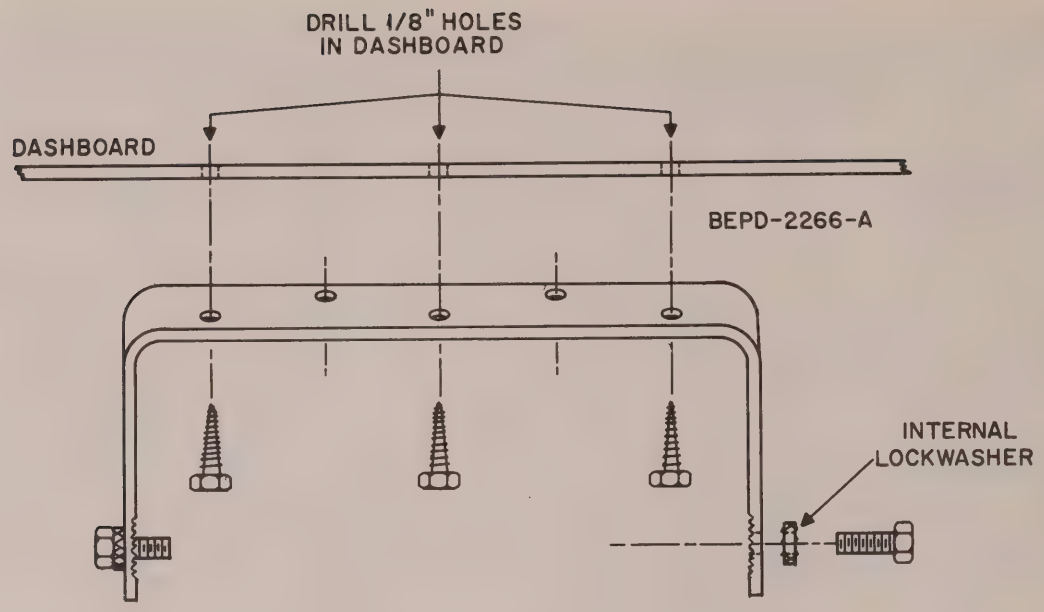


Figure 10.
Control Head Mounting Bracket

STEP 4.

POWER CONNECTIONS (Refer to Figures 2, 11 and 12)

Connect the fused power cable coming from the trunk, to the ungrounded terminal of the battery. Also connect the green fused wire coming from the control head to the ungrounded terminal of the battery.

Pull all excess cabling into the trunk. Clamp the cables to the vehicle body or chassis using the cable clamps supplied. Ascertain that all line fuses are installed.

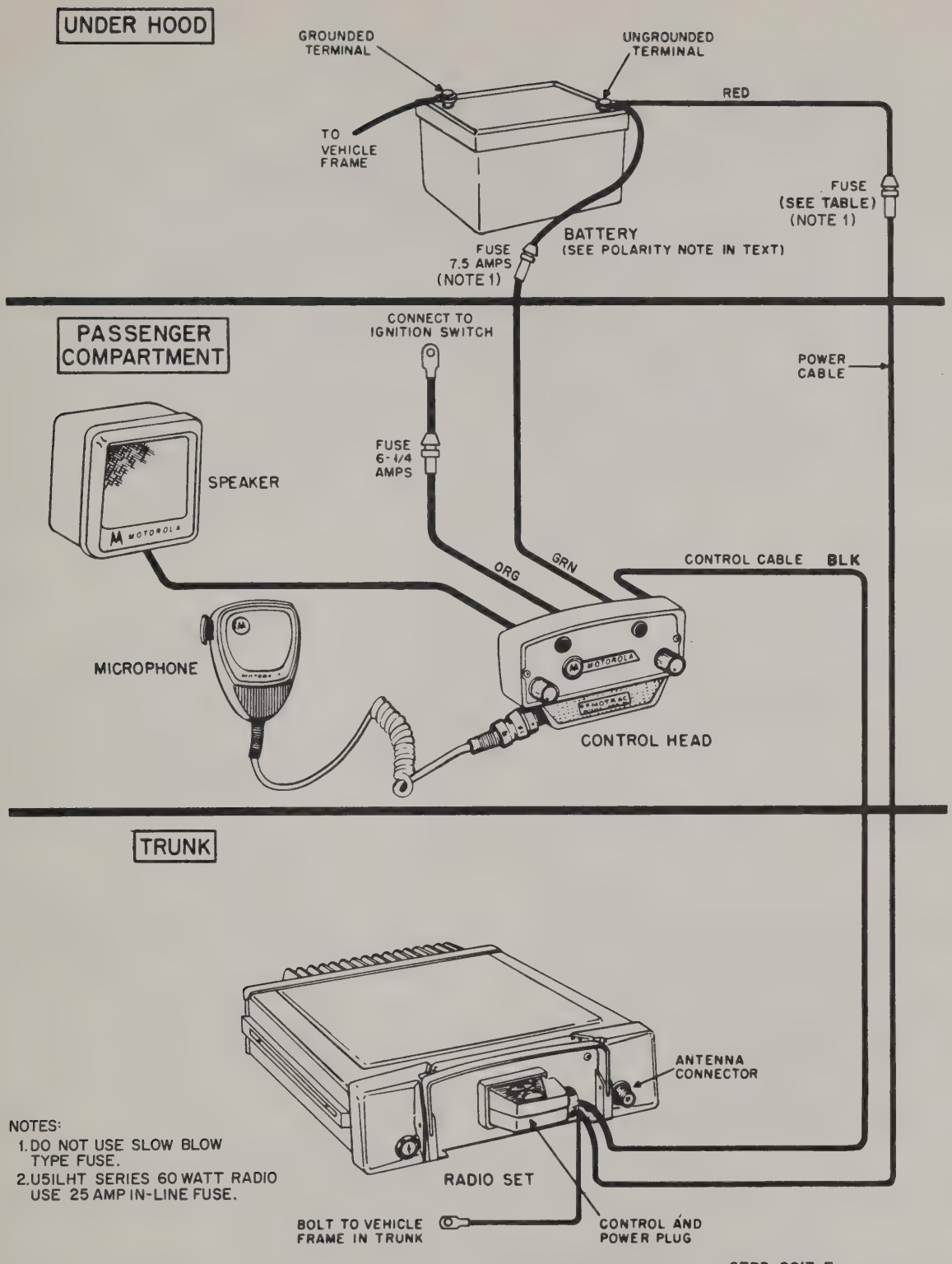
Check for proper fuses in Fuse Table of Figure 11. Cable type (1 or 2) is marked on the cable connector.

This completes the power connections for ignition switch control of transmitter operation. With these connections, the receiver is operating whenever the radio set is turned on, but the transmitter cannot be made operative until the ignition switch is also turned on. If it is desired that both the transmitter and the receiver be made operational with the radio set ON-OFF switch only, the orange lead may be connected directly to the ungrounded terminal of the battery.

STEP 5.

ANTENNA INSTALLATION

A diagram and complete installation instructions are supplied with each antenna ordered. Refer to these instructions for all information pertaining to the antenna.



NOTES:
1. DO NOT USE SLOW BLOW TYPE FUSE.
2. U5ILHT SERIES 60 WATT RADIO USE 25 AMP IN-LINE FUSE.

FUSE TABLE

CABLE TYPE	FUSE (NOTE 1)	
	RATING	MTG.
1 (NOTE 2)	35 AMPS.	BLOCK
2	25 AMPS.	IN-LINE

Figure 11.
Typical Installation - Wiring Detail

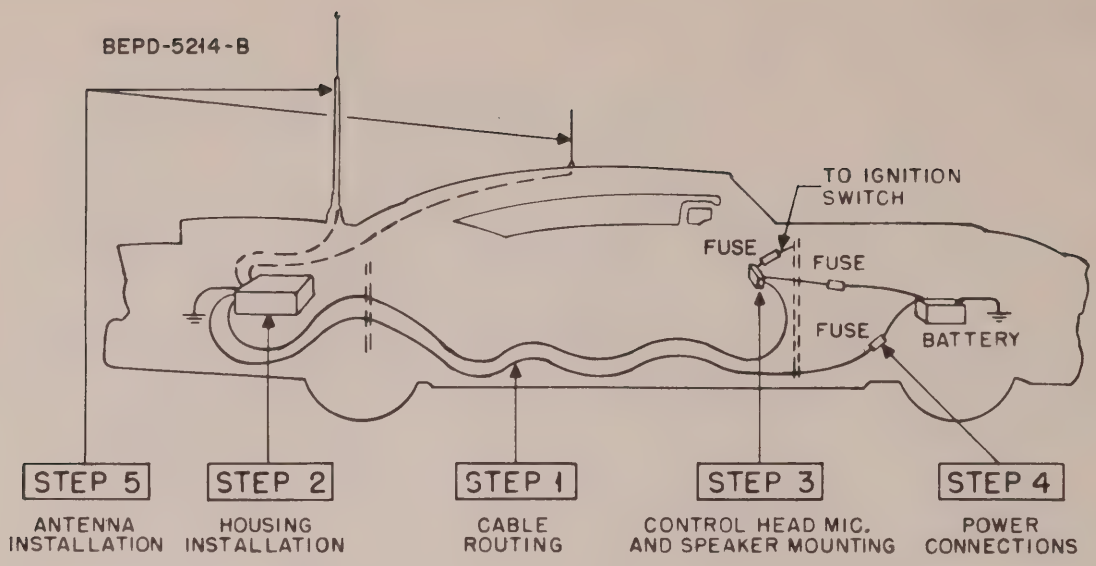


Figure 12.
Trunk-Mount Installation Steps

STEP 6.

NOISE REDUCTION

The TLN6252A Noise Reduction Kit consists of resistive and bonding cables, capacitors, and mounting hardware. Installation of these items reduces noise generated by the electrical system of the vehicle. Radio equipment operating in the 25-54 mc frequency range is more susceptible to impulse noise interference, therefore, this kit is supplied with Motorola 25-54 mc mobile two-way radio equipment.

The kit may be obtained as an optional accessory item for all other mobile two-way radio equipment.

The instruction booklet supplied with this kit outlines in details, the various types of noise interference and possible noise reduction methods.

DASH-MOUNT RADIO SETS ("MOTRAC" AND "MOTRAN" SETS ONLY)

STEP 1.

HOUSING INSTALLATION

Mounting brackets are supplied with the dash-mount radio set. Instructions for using the brackets to mount the radio set are packed with the brackets in the shipping carton.

STEP 2.

CONTROL HEAD, MICROPHONE AND SPEAKER INSTALLATION (See Figures 13 and 14)

CONTROL HEAD --- There is a 19-pin plug in the rear panel of the control head. Fit this plug into the receptacle in the front of the radio set and tighten 2 "Phillips" screws.

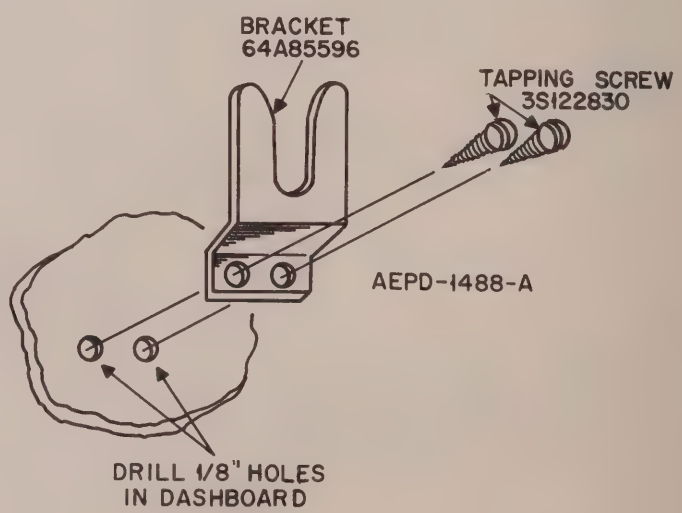


Figure 13.
Microphone Bracket Installation

BULB REPLACEMENT --- Pilot bulbs can be replaced from the front of the control head. Merely unscrew the red or green jewel by using the fingers. Use of a tool is unnecessary and can damage the finished surface. Use a finger or the eraser end of a pencil to remove the bulb from its bayonet type base.

MICROPHONE --- The microphone bracket should be within a comfortable arm reach of the driver. Measure this before actually mounting the bracket. Connect the microphone to the 4-pin receptacle on the control head.

SPEAKER --- Complete instructions for installing the speaker are packed with the speaker. Connect the speaker to the two-pin female plug attached to the cable on the control head.

STEP 3.

POWER CONNECTIONS

Route the four cables extending from the control head as follows:

Pass the two long red and black power cables into the engine compartment through the steering column opening in the fire wall. If necessary make a 1-1/16" diameter hole elsewhere in the firewall for these cables. Install the grommet (supplied) in this hole.

Remove the fuse from the red battery cable and do not reinstall it until the entire installation is complete.

Connect the red cable with the in-line fuse to the undergrounded terminal of the battery.

Connect the black cable to the grounded terminal of the battery.

Connect the orange wire directly to the ignition (or accessory) terminal of the ignition switch.

This completes the power connections for ignition switch control of transmitter operation. With these connections the receiver is operating whenever the radio set is turned on, but the transmitter cannot be made operative until the ignition switch is also turned on. If it is desired that both the transmitter and the receiver be made operational with the radio set ON-OFF switch only, the orange lead may be connected directly to the ungrounded terminal of the battery.

STEP 4.

ANTENNA INSTALLATION

A diagram and complete installation instructions are supplied with each antenna ordered. Refer to these instructions for all information pertaining to the antenna.

STEP 5.

FINAL CHECK

Make a final check of all cabling connections. Clamp the cables at appropriate points, using the cable clamps supplied in the installation kit. When everything is properly installed, replace the fuse in the battery cable.

STEP 6.

NOISE REDUCTION

Noise reduction kits consist of resistive and bonding cables, capacitors, and mounting hardware. Installation of these items reduces noise generated by the electrical system of the vehicle. Radio equipment operating in the 25-54 mc frequency range is more susceptible to impulse noise interference, therefore a kit is supplied with Motorola 25-54 mc mobile two-way radio equipment.

The kit may be obtained as an optional accessory item for all other mobile two-way radio equipment.

The instruction booklet supplied with this kit outlines in detail, the various types of noise interference and possible noise reduction methods.

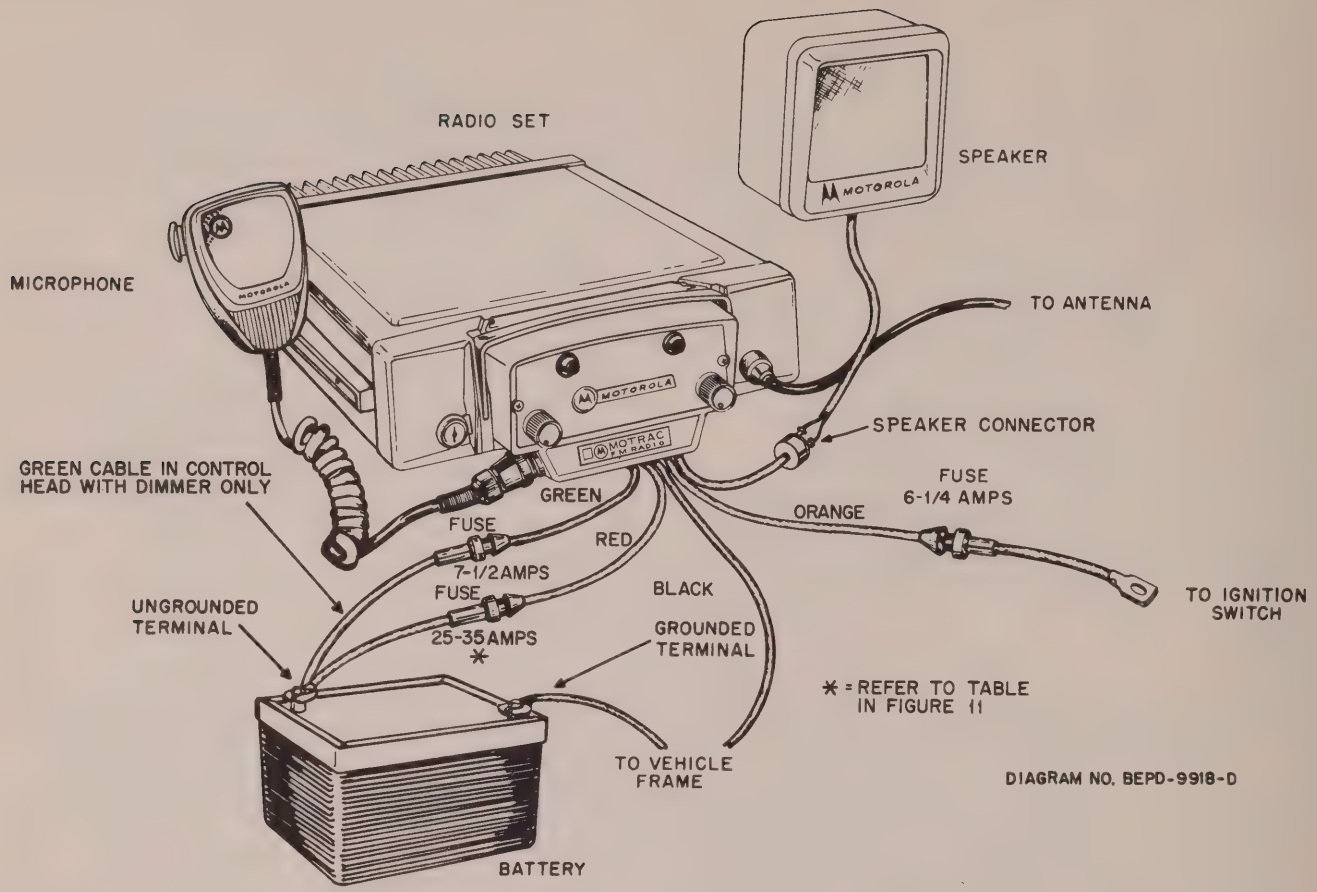


Figure 14.
Dash-Mount Installation Wiring Diagram

HOW TO USE JACKET

FOR DESK DRAWER
VERTICAL FILING

1. Lift up perforated tab on back of this jacket,

2. Choose gummed label (from sheet included) corresponding to part number shown in jacket front window.

3. Fasten gummed label as indicated on tab.

FOR BOOK SHELF FILING

1. Choose gummed label (from sheet included) corresponding to part number shown in jacket front window.

2. Fasten gummed label as indicated on back of jacket.

PLACE LABEL HERE